

Didcot Garden Town HIF1 Scheme

Environmental Statement Addendum

Oxfordshire County Council

October 2022

Quality information

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1. Introduction

- 1.1 On the 26th of April 2022, Oxfordshire County Council as Local Planning Authority (LPA) provided OCC as promoter of the Didcot Garden Town HIF 1 Scheme with a formal request for further information and evidence, under Regulation 25 of the Town and Country Planning (Environmental Impact Assessment) Regulations 2017 (as amended), in respect of the Environmental Statement (ES) submitted as part of the planning application (ref R3.0138/21) for the Didcot Garden Town HIF 1 Scheme. This request for further information and evidence is hereafter referred to as the 'Regulation 25 Request'.
- 1.2 A response to the Regulation 25 Request has been produced and is provided separately to this ES Addendum, which has been produced where the Regulation 25 Request has necessitated changes to the ES, including non-technical chapters, technical chapters, figures and appendices. The Regulation 25 Request should be read in conjunction with this ES Addendum.
- 1.3 The following aspects of the ES submitted in relation to planning application R3.0138/21 has been revised and are provided in this ES Addendum:
 - Chapter 5: General Consultation (see Annex 1);
 - Chapter 7: Cultural Heritage (see Annex 2);
 - Appendix 7.2: Cultural Heritage Desk Based Assessment (see Annex 3);
 - Chapter 8: Landscape and Visual Impact (see Annex 4);
 - Chapter 9: Biodiversity (see Annex 5);
 - Appendix 9.5: Reptile Survey Report (see Annex 6);
 - Appendix 9.6: Great Crested Newt Survey Report (see Annex 7);
 - Appendix 9.7: Breeding Birds Survey Report (see Annex 8);
 - Appendix 9.11: Otter and Water Vole Survey Report (see Annex 9);
 - Appendix 14.2: Water Framework Directive Report (a full WFD report has been produced) (see Annex 10); and
 - Figure 11.2: Agricultural Land Classification (see Annex 11).
- 1.4 Changes to chapters and reports are highlighted in yellow so the reader can more easily identify changes to these documents. However, Appendix 14.2: Water Framework Directive Report has undergone widespread changes and is therefore presented without yellow highlights.
- 1.5 The above documents hereby replace those submitted in with planning application ref R3.0138/21.
- 1.6 The remainder of the Environmental Statement submitted in relation to planning application ref R3.0138/21 should be read in conjunction with the enclosed revised chapters, reports and figures.
- 1.7 Amendments to the Environmental Statement, as a result of the Regulation 25 Request, in all cases have not changed the significance of any identified effects, significant or not significant.

Annex 1 – Chapter 5: General Consultation



REVISED

Didcot Garden Town HIF 1 Scheme

Environmental Statement

Volume I

Chapter 5 – General Consultation

October 2022

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5. General Consultation

5.1 Context

- 5.1.1 The following provides an overview of the consultation that has been undertaken between Oxfordshire County Council (OCC), the public, elected representatives and interest groups for the Housing Infrastructure Fund (HIF1) Scheme. The Statement of Community Involvement, submitted with the planning application of this Scheme, should be reviewed for a more detailed account of the consultation undertaken to date.
- 5.1.2 Pre-application engagement is a collaborative process between a prospective applicant and other interested parties which provides the applicant with valuable information to aid the progress of a development.
- 5.1.3 A stakeholder engagement strategy has been developed for the Scheme which identified a wide range of stakeholders (statutory and non-statutory consultees, including landowners and local people) with an interest in the Scheme. Consultation with stakeholders aims to identify their specific concerns and interests to feed into the development of the Scheme design.
- 5.1.4 The stakeholder engagement strategy for the Scheme was based on the following principles:
- Early and ongoing engagement to inform and influence the Scheme design development process;
 - Seeking an appropriate level of feedback at each stage in the iterative design process and ensuring that comments received are taken into consideration, where appropriate;
 - Building of long-term relationships with key stakeholders throughout the different stages of the Scheme to help better understand their views; and
 - Where possible and practicable ensuring concerns are addressed.

5.2 Planning requirements

- 5.2.1 OCC's Statement of Community Involvement adopted in May 2020 (Ref 5.1) sets out the requirement for notification and publicity for planning applications depending on their scale. Community consultation carried out in relation to this Scheme is based on the guidance in this document and it is considered best practice to consult with those impacted or interested in Schemes of this type. Paragraph 39 of the National Planning Policy Framework (NPPF) (Ref 5.2) states that *"Early engagement has significant potential to improve the efficiency and effectiveness of the planning application system for all parties. Good quality preapplication discussion enables better coordination between public and private resources and improved outcomes for the community"*.

5.3 Consultation to date

- 5.3.1 Consultation activities undertaken to date in relation to the Scheme are described in the sections below. Further details regarding the consultation undertaken for the Scheme are presented in the Statement of Community Involvement, submitted with the planning application, which details how consultation responses have been

considered during the Scheme design development. Refer to ES Chapter 3: Assessment of Alternatives for details on consultation responses to the alternatives.

5.4 Consultation on local plans

- 5.4.1 The four HIF 1 Schemes that together form ‘the Scheme’ (refer to ES Chapter 2: The Scheme), have been subject to numerous consultation periods during the production of Local Plans, including:
- The Oxfordshire County Council Local Transport Plan which included specific proposals for each of the HIF 1 schemes and was adopted in 2015, following public consultation on the draft plan earlier in the same year;
 - The Vale of the White Horse District Council Local Plan 2031 (Part 1 and 2) safeguards land for future transport schemes, including the majority of the land now included within the Site. This local plan was subject to public consultation in 2014. Part 2 refined the area required for the Didcot to Culham River Crossing and was subject to public consultation in 2017; and
 - The South Oxfordshire District Council Local Plan 2034 safeguards land for future transport schemes, including the majority of the land now included within the Site. This local plan was subject to public consultation in 2019.

5.5 Public consultation

- 5.5.1 OCC held public consultation events between the 2nd and 25th of November 2018 on the proposed package of strategic transport improvements for Didcot and the surrounding area, which will support planned growth as detailed in the Local Plan. The purpose of the consultation was to explain options being considered, and to show early indicative plans of the transport improvements which will support the bid for funding opportunities from the Government, such as the Housing Infrastructure Fund (HIF). A total of 307 responses were received during the consultation period. The feedback from received during the consultation period helped to inform the Scheme design. Further information on this consultation is available here: www.oxfordshire.gov.uk/didcot.
- 5.5.2 A public consultation was held from the 20th of March to the 30th of April 2020 on the feasibility design of the Scheme. Public consultation events were planned for the Scheme, however due to Government’s guidance on social distancing in response to COVID-19, the in-person were events were not able to go ahead. Several measures were introduced to ensure people could still participate, including holding an online consultation (which included a live chat function), hosted on the OCC website. However, printed versions of the materials were sent to those who requested them due to lack of internet access. The consultation was originally planned to last 4 weeks, which is usual for a non-statutory consultation, but this duration was extended to 6 weeks to allow people more time to respond.
- 5.5.3 In total 686 responses were received. Further information on this consultation can be found within the July 2020 OCC Cabinet Report here: https://mycouncil.oxfordshire.gov.uk/documents/s52047/CA_JUL2120R03%20Didcot%20Garden%20Town%20HIF%201.pdf. This is also documented in the Statement of Community Involvement, submitted with the planning application for this Scheme.

5.6 Consultation with elected representatives and other local groups

- 5.6.1 Frequent consultation has also been undertaken with elected representatives relevant to the Scheme. This is documented in the Statement of Community Involvement, submitted with the planning application for the Scheme. In addition, consultation with local non-motorised user (NMU) groups has been undertaken to inform the production of the Walking, Cycling and Horse Rider (WCH) Assessment Report (WCHAR). The aim of the WCHAR was to gain an understanding of all relevant existing facilities for pedestrians, cyclists and horse-riders (the users) in the local area, to provide background user information that can be referred to throughout the design process and to identify opportunities for improvement for users. The WCHAR has been submitted as part of the planning application submission for this Scheme.
- 5.6.2 Prior to the submission of the planning application, online meetings took place on the 13th of May and the 10th of June 2021 with key NMU groups. The aim of these meetings was to provide an update on the project and highlight changes to the proposed plans since the 2020 consultation.
- 5.6.3 The design team will continue to engage with these NMU interest groups and consider opportunities for further improvements throughout the progression of the detailed design for the Scheme.
- 5.6.4 Letters were also sent to the adjacent land/property owners (i.e. those immediately impacted by the Scheme but outside of the Scheme boundary) to offer a meeting to explain the Scheme and answer any questions in advance of the planning submission.

5.7 Other consultation undertaken during the EIA process

- 5.7.1 An EIA Scoping Report was submitted by OCC to the Local Planning Authority (LPA) in April 2020. A Scoping Opinion was received in July 2020 which detailed the opinions of both statutory and non-statutory consultees. The EIA undertaken and reported in this ES, was based on the Scoping Opinion. These are available in Appendix 4.1.
- 5.7.2 Each of the technical assessments, reported within this ES, have been subject to consultation with the relevant statutory consultees, details of which are provided within Section 3 of each technical chapters (refer to Chapters 6 to 17).

5.8 Future engagement

- 5.8.1 The planning application, and therefore the ES, will be advertised through the procedures set out within The Town and Country Planning (Development Management Procedure) (England) Order 2015 (Part 3, 15 and 16) (Ref 5.3), which will be undertaken by OCC as the relevant planning authority. This will include publicising the planning application through site display in at least one place on or near the land to which the application relates for no less than 21 days and by publication of a notice in a newspaper circulating in the locality in which the land to which the application relates is situated. This is the standard procedure for publicising an EIA development within England.
- 5.8.2 Additionally, the Town and Country Planning (EIA) Regulations 2017 (as amended) (Ref 5.4), include publication provisions under Part 19. These state that the applicant must submit a copy of the ES to the relevant planning authority. This can be submitted

digitally and does not have to include a physical paper copy of the ES. Upon receiving this ES, OCC as the relevant planning authority, will:

- Send a copy to the Secretary of State, within 14 days of receipt of the ES, and any other documents submitted with the application;
- Forward the ES to any consultation body, which has not received a copy directly from the applicant, a copy of the environmental statement and inform any such consultation body that they may make representations (there is no requirement for the applicant to forward the ES to consultation bodies); and
- Forward the ES to any other interested parties or persons.

5.9 References

Ref 5.1 National Planning Policy Framework. Department for Communities and Local Government

Ref 5.2 Didcot Garden Town HIF 1 Scheme, Statement of Community Involvement, AECOM, 2021.

Ref 5.3 The Town and Country Planning (Development Management Procedure) (England) Order 2015 <https://www.legislation.gov.uk/uksi/2015/595/contents/made>

Ref 5.4 The Town and Country Planning (Environmental Impact Assessment) Regulations 2017 <https://www.legislation.gov.uk/uksi/2017/571/contents/made>

Annex 2 – Chapter 7: Cultural Heritage



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Didcot Garden Town HIF 1 Scheme

Environmental Statement

Volume I

Chapter 7 – Cultural Heritage

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7. Cultural Heritage

7.1 Introduction

- 7.1.1 This Environmental Statement (ES) chapter has been produced to assess the cultural heritage impacts of the Didcot Garden Town Housing Infrastructure Fund (HIF 1) Scheme (hereafter referred to as the 'Scheme'). This chapter should be read in conjunction with Chapters 1 to 5 of this ES.
- 7.1.2 Using the methodology outlined in Section 7.4, likely significant cultural heritage effects (adverse and beneficial) have been identified and are described in Section 7.10. A summary of these likely significant effects is provided in Section 7.13 and must be read in conjunction with the whole chapter.

Competent expertise

- 7.1.3 This chapter of the ES has been prepared by competent experts with relevant and appropriate experience. The Technical Lead for this cultural heritage chapter has 40 years of relevant experience and has professional qualifications as summarised in Appendix 1.1.

7.2 Legislative and policy framework

- 7.2.1 The following sub-sections provide information on the legislation and policies that are of most relevance to the cultural heritage assessment, namely where these have informed the identification of receptors and resources and their sensitivity; the assessment methodology; the potential for significant environmental effects; and required mitigation.
- 7.2.2 The Cultural Heritage Desk Based Assessment (CHDBA) (refer to Appendix 7.2) provides further detail on legislation and policy relating to cultural heritage.

Legislation

The Ancient Monuments and Archaeological Areas Act 1979 (as amended) (Ref 7.1)

- 7.2.3 The Ancient Monuments and Archaeological Areas Act imposes a requirement for Scheduled Monument Consent for any works of demolition, repair, and alteration that might affect a designated Scheduled Monument (SM).

The Planning (Listed Buildings and Conservation Areas) Act 1990 (Ref 7.2)

- 7.2.4 The Planning (Listed Buildings and Conservation Areas) Act 1990 (the Act) sets out the principal statutory provisions that must be considered in the determination of any application affecting listed buildings and conservation areas.
- 7.2.5 Section 66 of the Act states that in considering whether to grant planning permission for development which affects a listed building or its setting, the local planning authority or, as the case may be, the Secretary of State, shall have special regard to the desirability of preserving the building or its setting or any features of special architectural or historic interest which it possesses. By virtue of Section 1(5) of the Act a listed building includes any object or structure within its curtilage.

- 7.2.6 Section 72 of the Act establishes a general duty on a local planning authority or the Secretary of State with respect to any buildings or other land in a Conservation Area to pay special attention to the desirability of preserving or enhancing the character or appearance of a Conservation Area.

National planning policy

National Planning Policy Framework (NPPF) (Ref 7.3)

- 7.2.7 The NPPF (Ministry of Housing, Communities and Local Government (MHCLG), 2021) (Ref 7.3) sets out the Government's planning policies for England and how these should be applied to contribute to the achievement of sustainable development. While the Environmental Impact Assessment (EIA) methodology forms part of a separate planning regime, the planning decision still takes account of national guidance. As such, it is important to understand where the development fits within this.

- 7.2.8 Section 16 of the NPPF deals specifically with the historic environment. Where changes are proposed, the NPPF sets out a clear framework to ensure that heritage assets are conserved, and where appropriate enhanced, in a manner that is consistent with their significance.

Planning Policy Guidance (PPG) (Ref 7.4)

- 7.2.9 The PPG (MHCLG 2019) (Ref 7.4) is an on-line government document that provides further advice and guidance to accompany policies in the NPPF. It expands on terms such as 'significance' and its importance in decision making. In particular, paragraph 008 states that:

"understanding the significance of a heritage asset and its setting from an early stage in the design process can help to inform the development of proposals which avoid or minimise harm. Analysis of relevant information can generate a clear understanding of the affected asset, the heritage interests represented in it, and their relative importance"

(Paragraph 008, Ref. ID: 18a-008-20190723, Revision date: 23 07 2019).

Local planning policy

Vale of White Horse District Council (VoWHDC)

- 7.2.10 Part 1 of the VoWHDC Local Plan (Vale of White Horse Local Plan, 2016) (Ref 7.5), adopted in December 2016, sets out the Council's core policy with regards to the historic environment.
- 7.2.11 Part 2 of the Local Plan 2031 (Detailed Policies and Additional Sites, 2019) (Ref 7.6) was adopted on the 9th October 2019. Development policies within the Local Plan relating to heritage include policy 36 (Heritage Assets), policy 37 (Conservation Areas), policy 38 (Listed Buildings), and policy 39 (Archaeology and Scheduled Monuments).

South Oxfordshire District Council (SODC)

- 7.2.12 Chapter 7 of the South Oxfordshire Local Plan 2035 (Ref 7.7), adopted on 10th December 2020, sets out policies that aim to conserve the natural and historic environment. Development policies within the Local Plan relating to heritage include policy ENV6: (Historic Environment), policy ENV7 (Listed Buildings), policy ENV 8

(Conservation Areas), policy ENV 9 (Archaeology and Scheduled Monuments), policy ENV10 (Historic Battlefields, Registered Parks and Gardens and Historic Landscapes).

The Burcot and Clifton Hampden Neighbourhood Plan 2011-2034 – Pre-Submission Draft (Nov 2020) (Ref 7.8)

- 7.2.13 Draft policies BCH6 ‘Design Principles in Clifton Hampden’ and BCH9 ‘Local Landscape Character’ are of relevance to this cultural heritage assessment.

7.3 Consultation with relevant stakeholders

- 7.3.1 Initial consultation with the Oxfordshire County Council (OCC) Archaeologist was conducted on the 15th November 2019. The OCC Archaeologist requested that the EIA use a study area of 1 km (buffer zone) for designated and non-designated cultural heritage resources.
- 7.3.2 A meeting took place on the 5th March 2020 with OCC Archaeologists, Historic England and OCC as the Scheme promoter. During this consultation a thorough overview and high-level programme review was provided followed by a discussion on locations of most concern in terms of likelihood of archaeological remains surviving and therefore likely impacts. Areas of less concern were also discussed. Historic England also noted concerns regarding the setting of heritage assets, particularly Nuneham Courtenay Grade I Registered Park and Garden.
- 7.3.3 Consultation with the OCC Archaeologist occurred throughout the EIA process, with regards to scope and method of desk-based assessment and archaeological evaluation.
- 7.3.4 An EIA Scoping Opinion Request was submitted by OCC (as the promoter) to OCC in its capacity as the Local Planning Authority (LPA) in April 2020, which sought the opinion of the LPA regarding the approach for the assessment of environmental effects resulting from the construction and operation of the Scheme. In accordance with the EIA Regulations, the LPA consulted statutory stakeholders and non-statutory stakeholders where they considered it applicable. The consultation responses detailed in Table 7.1 were received in relation to cultural heritage.

Table 7.1: Scoping Opinion and responses

Scoping Opinion	Where addressed within the ES
OCC Archaeology Officer	
A programme of archaeological investigation will need to be undertaken ahead of the determination of any planning application for the site. This will need to include a geophysical survey as well as a trenched evaluation. The results of this geophysical survey and evaluation should be incorporated into the Cultural Heritage chapter of the EIA.	Geophysical survey has been carried out to written schemes of investigation agreed with the OCC Archaeology Officer - results obtained have been incorporated into this chapter. The relevant report is presented in Appendix 7.3. Fieldwork for the trial trench evaluation has been completed and the report is pending. The trial trench evaluation report will be submitted early in the determination process. This approach has been agreed with the Archaeology Officer for OCC.
Historic England	
This development could, potentially, have an impact upon a number of designated and undesignated heritage assets and their settings. We will expect the ES to contain a thorough assessment of the likely	The assessment of effects to designated and non-designated heritage assets is presented in this chapter, supported by the

Scoping Opinion	Where addressed within the ES
effects which the proposed development might have upon those elements which contribute to the significance of these assets.	baseline technical appendices (Appendix 7.2); and Figures 2 and 3.
The ES should also identify impacts which the proposals might have upon heritage assets (and their settings) which are not designated, as these are also valued components of the historic environment. In some cases, they may also be of equivalent significance to, and be given equivalent weight to, designated assets, as set out in the NPPF (2019), footnote 63. For example, the area, being on the Thames Gravels, is rich in archaeological remains and has several known concentrations of early activity indicated by cropmarks. Further such sites may exist but have not yet been discovered.	The assessment of effects to designated and non-designated heritage assets is presented in this chapter, supported by the baseline technical appendix (Appendix 7.2); and Figures 2 and 3.
The assessment should also take account of the potential impact which associated activities (such as construction, servicing and maintenance, and associated traffic) might have upon perceptions, understanding and appreciation of the heritage assets in the area.	These elements are considered as part of the assessment presented in this chapter.
<p>The likely effects which the proposed development might have upon both designated and undesignated historic assets and their settings and those elements which contribute to the significance of these assets should be assessed including:</p> <ul style="list-style-type: none"> • Scheduled monument: Settlement site north of the Thames, HA1006345 • Scheduled Monument: Round barrow cemetery at Fullamoor Plantation, HA1421606 • Scheduled Monument: Settlement site NE of Church, HA1004849 • Grade I Registered Nuneham Courtenay Park • All Listed Buildings • The Conservation Areas at Clifton Hampden and Culham <p>The assessment should also take account of the potential impact which associated activities (such as construction, servicing and maintenance, and associated traffic) might have upon perceptions, understanding and appreciation of the heritage assets in the area.</p>	<p>These assets have been considered as part of the assessment.</p> <p>The baseline technical appendix (Appendix 7.2) sets out the rationale for selection. Two scheduled monuments HA1421606 (Appendix 7.2, 5.2.8-5.2.9) and HA1004849 (Appendix 7.2, 5.2.4-5.2.5) were scoped out of further assessment within this chapter. Likewise, the baseline technical appendix concluded that a number of listed buildings and conservation areas within the study area will not be significantly affected by the Scheme and these were thus scoped out of further assessment. This included Culham Conservation Area (see Table 5.8 in Appendix 7.2).</p> <p>The assessment of the impacts of the Scheme upon Nuneham Courtenay Grade I Registered Park and Garden is presented in Section 7.10.</p> <p>The assessment of the impacts of the Scheme upon Clifton Hampden Conservation Area is presented in Section 7.10.</p>
As the project includes new roads, any traffic impacts on surrounding heritage assets must be carefully assessed. This includes listed buildings and conservation areas in the historic village of Nuneham Courtenay, and in Milton, Appleford, Sutton Courtenay, Clifton Hampden, Culham, and Abingdon.	<p>These elements are considered as part of the assessment presented in this chapter and in the baseline appendix (Appendix 7.2).</p> <p>The settlements of Nuneham Courtenay and Abingdon were outside the formal study area for this assessment and for the study area for detailed transport modelling and assessment in ES Chapter 16: Transport and the Transport Assessment (TA) submitted with the planning application. No significant changes to traffic volumes are anticipated in those settlements and therefore this chapter found no potential for</p>

Scoping Opinion	Where addressed within the ES
	significant effects to the heritage assets contained within them. They are not considered further in this assessment.
The assessment should also consider, where appropriate, the likelihood of alterations to drainage patterns that might lead to in situ decomposition or destruction of below ground archaeological remains and deposits and can also lead to subsidence of buildings and monuments.	These elements are considered as part of the assessment presented in this chapter.
Techniques such as additional aerial photography, additional LIDAR survey, and fieldwalking, which are not mentioned in the scoping report, should also be considered.	Geophysical survey and trial trench evaluation has been agreed with the OCC Archaeology Officer. LIDAR data available from the Environment Agency and cropmark evidence provided by the Historic England Archive have been included within the assessment and are presented on Figure 20 of Appendix 7.2.
The EIA Scoping Report assesses value of identified designated heritage assets based on their listing grade. This is set out in Table 7.1. We advise this approach is problematic, for two reasons. Firstly, the values (receptor sensitivity) allocated should be reconsidered. For example, only World Heritage Sites have been listed as 'Very High', when the NPPF (para 194) is quite clear that assets of the 'highest value' include 'scheduled monuments, protected wreck sites, registered battlefields, Grade I and II* listed buildings, Grade I and II* registered parks and gardens'. Also, Grade II buildings may be of national rather than regional value, and some undesignated heritage assets may be of higher value than the medium level that they have been placed in.	<p>The assessed level of value (receptor sensitivity) of all known designated and non-designated assets is provided in Appendix 7.1.</p> <p>The assignment of value has been reviewed between the production of the Scoping Report and the production of the ES, resulting in Grade II listed buildings now being assigned to the High value category based on their national significance.</p> <p>The assignment of value is led by the methodology contained in DMRB (2019) which reserves the 'Very High' category for assets of international importance. In the context of heritage assets, this is interpreted as World Heritage Sites and assets of equivalent value. As such, the ES categorises Grade I and II* listed buildings and scheduled monuments as 'High' value, although in each their potential to hold international importance has been considered using professional judgement.</p>
A number of designated heritage assets, whose value in the Gazetteer has been identified as 'medium', should be reconsidered cumulatively and their value reassessed accordingly.	This has been undertaken as part of the assessment. For example, a number of non-designated buildings around Culham railway station [A262, A263 and A264] have been assigned to the 'medium' value category, rather than low, based on their group value with each other and with the Grade II* listed Culham Station and Ticket Office.
The exceptionally significant designed landscape and highly heritage sensitive site of the Grade-I registered Nuneham Courtenay Park, including the listed structures within its grounds, could be significantly affected by the proposals. In particular, the park, which overlies undulating hills, with a steep slope towards the west boundary, where the land drops down to the Thames, includes important long views	The assessment of the impacts of the Scheme upon Nuneham Courtenay Grade I Registered Park and Garden is presented in Section 7.10.

Scoping Opinion	Where addressed within the ES
towards Abingdon that should be preserved, together with its almost rural setting.	
The Design Manual for Roads and Bridges (DMRB) is now quite an old document and has limitations. We therefore advise the additional use of more up-to-date guidance including that published by Historic England. Paragraphs 189 and 190 of the NPPF also set out the overriding principle of appropriate assessment of significance and impact.	The DMRB methodology followed was updated in 2019. Notwithstanding this, the assessment has also been undertaken utilising NPPF, Historic England and other relevant standards and guidance (Section 7.4).
The cultural heritage section(s) of the ES should be consistent with, and cross-referenced to other sections, particularly the landscape and visual assessment, and sections on hydrology.	Appropriate cross references are provided within this chapter and the baseline technical appendix (Appendix 7.2). The assessment has been carried out in collaboration with other EIA disciplines. It should be noted, however, that where information from other disciplines is used to assess effects upon heritage assets, this is focused on the impacts to the significance of the heritage asset. As such the same assessed level of impact is not automatically repeated across different chapters. For example, an assessed significant effect in the noise chapter will not necessarily result in significant effects to a heritage asset that is not sensitive to changes in noise within its setting. Likewise, a non-significant effect reported in the landscape chapter may in fact result in a significant effect on an individual heritage asset. In this regard the cultural heritage chapter may not therefore be 'consistent' with other sections of the ES.
Cumulative impacts from these proposed schemes and other schemes should be assessed – the proposed mineral extraction allocation at Nuneham Courtenay is a case in point.	Cumulative impacts are assessed in ES Chapter 17.
SODC and VoWHDC – Cultural Heritage	
A4130 - Impact of increased traffic through Milton village could be a secondary impact of development that could have an impact upon significance	This has been considered as part of the ES and presented in Table 5.10 of the baseline technical appendix (Appendix 7.2).
River Crossing - It will be important to weigh up the relative harm arising from Option 1 versus Option 2. Based on a limited understanding of the significance of the heritage assets identified above, Option 2 may pose the least harm overall in heritage terms. It is unclear at this stage whether Appleford Bridge will be directly affected by the proposals and whether there will be any substantial impacts upon significance that will weigh in favour of Option 2.	Only Option 2 has been taken forward to assessment within the ES and has been subject to further changes following the iterative EIA process. These amendments are described in ES Chapter 3: Assessment of Alternatives. When the Scoping Request was submitted to OCC, the alignment for the Didcot to Culham River Crossing was not fixed and therefore, the Scoping Opinion Request focused on two possible alignments. Option 1, which was located closer to Appleford Village, was later discounted and has therefore not been assessed within this ES. Chapter 3: Assessment of Alternatives provides additional rationale for why this option was not taken forward.

Scoping Opinion	Where addressed within the ES
	There are no impacts assessed upon Appleford Bridge (see Table 5.10 of Appendix 7.2).
<p>Clifton Hampden Bypass - This element of the works shown are likely to pose a higher level of potential harm to heritage assets of high significance. It is essential that the significance of Grade II* listed Nuneham House is included in the EIA; the wider parkland which is identified forms an important part of its setting.</p> <p>Secondary impacts to significance such as those arising from lighting and noise will need to be assessed as well as the direct changes to the landscape. If an application is made it should be informed by a Heritage Appraisal and Impact Assessment proportionate to the significance of the building and the proposed works as per Paragraph 189 of the NPPF.</p>	<p>The Nuneham Courtenay Conservation Area and Grade I Registered Park and Garden is assessed in Section 7.10 with further information provided in Appendix 7.2. The listed buildings within the park, including the Grade II* listed Nuneham House, are considered as part of that assessment with particular attention paid to key views. This is considered to be a proportionate assessment of the heritage significance of the asset and the potential effects of the Scheme.</p> <p>Only the very edge of Nuneham Park falls within the detailed operational traffic noise study area and Nuneham House is outside the area considered for detailed noise modelling (ES Chapter 10: Noise). The noise assessment has, however, assessed the element of the park that fall within the detailed study area for noise assessment through taking a representative point at the point where the extent of the park is closest to the Scheme. It has also considered two assets within the park and within the 1 km heritage study area, Venison House and Keepers Cottage as representative of effects on the park, both of those assets are outside the detailed noise modelling study area, so only qualitative comment has been provided. The results of these assessments are discussed in Section 7.10.</p> <p>The asset's sensitivity to changes in lighting levels within its setting has been considered in the design of the Scheme. Sections of the Clifton Hampden Bypass will be lit, however lighting will be kept to a minimum to reduce environmental impacts (see ES Chapter 2: The Scheme).</p>

7.4 Assessment methodology

- 7.4.1 This cultural heritage assessment has been undertaken in accordance with the guidance as detailed in the sections below and overleaf.

Design Manual for Roads and Bridges (DMRB)

- 7.4.2 The following DMRB (Ref 7.9) standards have been applied in the assessment to identify the value and significance of archaeological remains, historic buildings and historic landscapes, and to identify and evaluate the impacts and effects that construction and operation of the Scheme will likely have on these assets:
- LA 104: Environmental assessment and monitoring (Ref 7.10);
 - LA 106: Cultural heritage assessment (Ref 7.11); and
 - LA 116: Cultural heritage assessment management plans (Ref 7.12) has been used in the assessment to guide the development of mitigation measures.

Chartered Institute for Archaeologists standards and guidance

- 7.4.3 The assessment has been undertaken by a competent expert in the discipline of cultural heritage in line with best practice standards and guidance published by the Chartered Institute for Archaeologists (CIfA):
- Code of Conduct (Ref 7.13) – which sets out standards of ethical and responsible behaviour in the conduct of archaeological affairs to which members of the institute are expected to adhere;
 - Standard and guidance for historic environment desk-based assessment (Ref 7.14) – which sets out the appropriate standards for undertaking desk-based cultural heritage assessments; and
 - Principles of Cultural Heritage Impact Assessment in the UK (Ref 7.15) – which provides guidance for cultural heritage practitioners on the principles of cultural heritage impact assessment.

Historic England Guidance

- 7.4.4 The following Historic England good practice advice notes and guidance have been used in the assessment to assist in establishing the significance of cultural heritage assets and their setting:
- Managing Significance in Decision-taking. Historic Environment Good Practice Advice in Planning: 2 (Ref 7.16) – which emphasises the importance of having knowledge and understanding of the significance of heritage assets likely to be affected by the development, and where relevant the contribution of their settings to their significance;
 - The Setting of Heritage Assets. Historic Environment Good Practice Advice in Planning: 3 (Ref 7.17) – which advises that elements of a setting can make positive or negative contributions to an asset's significance and the ways in which it is experienced. It acknowledges that settings can overlap due to not having defined boundaries, and that settings can change as an asset and/or its surroundings evolve over time; and
 - Statements of Heritage Significance: Analysing Significance in Heritage Assets. Historic England Advice Note 12 (Ref 7.18) – which explores the assessment of significance of heritage assets as part as a staged approach to decision making.

Establishment of the baseline

- 7.4.5 The cultural heritage baseline was developed through collation of existing data sources, consultation with statutory bodies and fieldwork surveys in line with the standard and guidance for historic environment desk-based assessment; and OCC Archaeological Desk-Based Assessment advisory document (Ref 7.19). The desk-based assessment was undertaken in compliance with a Written Scheme of Investigation (WSI) (Ref 7.20) prepared and agreed with OCC Archaeological Services (OCCAS) prior to the preparation of the desk-based assessment.
- 7.4.6 A geophysical survey and archaeological trial trench evaluation were carried out in compliance with WSIs prepared and agreed with OCCAS.
- 7.4.7 The baseline conditions described below summarise the detailed desk-based information and fieldwork surveys reported in the following appendices of the ES:
- Appendix 7.1 – Gazetteer of Cultural Heritage Assets;
 - Appendix 7.2 – Desk-based Assessment; and

- Appendix 7.3 – Geophysical Survey.

Value of heritage assets

- 7.4.8 The value of a building, monument, area, site, place or landscape reflects its significance as a historic asset and therefore its sensitivity to change.
- 7.4.9 The requirement to assess the significance of heritage assets is also set out within ClfA guidance (Ref 7-14).
- 7.4.10 The NPPF (Ref 7-3) defines the significance (value) of heritage assets as: *“The value of a heritage asset to this and future generations because of its heritage interest. Significance derives not only from a heritage asset’s physical presence, but also from its setting”*. It also sets out criteria which should be considered when assessing the significance of cultural heritage assets, which include archaeological, architectural, artistic and historic values.
- 7.4.11 Certain types of heritage asset have a level of significance (value) that justify official designation, such as scheduled monuments and listed buildings; however, the absence of designation does not necessarily mean heritage assets are of lower value or significance.
- 7.4.12 Professional judgement has been used to identify the value and significance of assets guided by legislation (Ref 7.1 and Ref 7.2), national planning policy and guidance (Ref 7.3 and Ref 7.16), standards, official designations, and the assessment criteria contained in LA 104 (Ref 7.10) (reproduced in Table 7.2).

Table 7.2: Environmental value (sensitivity) and descriptions

Value (sensitivity) of receptor/ resource	Typical description
Very High	Very high importance and rarity, international scale and very limited potential for substitution.
High	High importance and rarity, national scale, and limited potential for substitution.
Medium	Medium or high importance and rarity, regional scale, limited potential for substitution.
Low	Low or medium importance and rarity, local scale.
Negligible	Very low importance and rarity, local scale.

Magnitude of impact criteria

- 7.4.13 Impacts have been identified by reviewing the identified sites, features and areas (heritage assets) within the defined study areas (see Section 7.6) against the form and extent of the Scheme, in order to establish which assets will be affected by its construction and operation.
- 7.4.14 Impacts identified in the assessment relate to the predicted changes to key elements of an asset and/ or its setting. These can, for example, derive from temporary or permanent actions such as the physical destruction of buried archaeology during construction works, and the introduction of new highway infrastructure into the setting of a historic building.

7.4.15 The identification of impacts takes account the Scheme design, including embedded mitigation measures, as described in ES Chapter 2: The Scheme (and summarised in Section 7.9) and essential mitigation measures described in Section 7.9.

7.4.16 The magnitude of impact has been assessed using the criteria contained in DMRB LA 104 (Ref 7.10) (Table 7.3).

Table 7.3: Magnitude of impact and typical descriptions

Magnitude of impact (change)		Typical description
Major	Adverse	Loss of resource and/ or quality and integrity of resource; severe damage to key characteristics, features or elements.
	Beneficial	Large scale or major improvement of resource quality; extensive restoration; major improvement of attribute quality.
Moderate	Adverse	Loss of resource, but not adversely affecting the integrity; partial loss of/ damage to key characteristics, features or elements.
	Beneficial	Benefit to, or addition of, key characteristics, features or elements; improvement of attribute quality.
Minor	Adverse	Some measurable change in attributes, quality or vulnerability; minor loss of, or alteration to, one (maybe more) key characteristics, features or elements.
	Beneficial	Minor benefit to, or addition of, one (maybe more) key characteristics, features or elements; some beneficial impact on attribute or a reduced risk of negative impact occurring.
Negligible	Adverse	Very minor loss or detrimental alteration to one or more characteristics, features or elements.
	Beneficial	Very minor benefit to or positive addition of one or more characteristics, features or elements.
No change		No loss or alteration of characteristics, features or elements; no observable impact in either direction.

Significance of Effect

7.4.17 The identification of the likely significant effects on cultural heritage assets has relied on reasoned argument, the professional judgement of the competent experts, and consultation with stakeholders. It has also been informed by knowledge and experience gained from assessments of similar highway schemes.

7.4.18 The assignment of effects has involved combining the value of an asset with the predicted magnitude of impact, guided by the significance matrix set out in LA 104 (Ref 7.10) (Table 7.4).

Table 7.4: Significance of effect matrix

		Magnitude of impact (change)				
		No change	Negligible	Minor	Moderate	Major
Environmental value (sensitivity)	Very High	Neutral	Slight	Moderate or Large	Large or Very Large	Very Large
	High	Neutral	Slight	Slight or Moderate	Moderate or Large	Large or Very Large
	Medium	Neutral	Neutral or Slight	Slight	Moderate	Moderate or Large
	Low	Neutral	Neutral or Slight	Neutral or Slight	Slight	Slight or Moderate
	Negligible	Neutral	Neutral	Neutral or Slight	Neutral or Slight	Slight

Assessment of harm to designated heritage assets

- 7.4.19 The NPPF (Ref 7.3) sets out requirements to consider whether the impacts of a development on a designated heritage asset amounts to substantial harm to or total loss of, or less than substantial harm to its significance (value).
- 7.4.20 There is no direct correlation between the significance of effect reported in this chapter and the level of harm on the significance (value) of designated heritage assets resulting from the Scheme. Notwithstanding this:
- A very large or large (significant) effect on a heritage asset (including total loss of significance) will typically form the basis by which to determine that the level of harm to the significance (value) of a designated asset will be substantial. However, substantial harm is considered to be a high test (in other words extensive changes to significance) and a case-by-case assessment should be made;
 - A moderate (significant) effect is unlikely to meet the test of substantial harm and will therefore typically form the basis by which to determine that the level of harm to the significance (value) of a designated asset will be less than substantial;
 - A minor or negligible (not significant) effect will typically amount to less than substantial harm to the significance (value) of a designated asset; and
 - A neutral effect amounts to no harm on the significance (value) of a designated asset.
- 7.4.21 In all cases, the determination of the level of harm to the significance (value) of a designated heritage asset arising from construction or operation of the Scheme has been led by professional judgement.
- 7.4.22 The assessment of harm on designated heritage assets resulting from the Scheme in respect of the policy requirements of the NPPF (Ref 7.3) are detailed in Section 7.12.

Sources of Information/Data

- 7.4.23 The following sources of information have been reviewed and form the basis of the assessment of likely significant effects on cultural heritage:
- Oxfordshire County Historic Environment Record (HER);
 - National Heritage List for England held by Historic England;

- Designated assets such as Scheduled Monuments, Battlefields and Listed Buildings;
- Ordnance Survey maps (19th and 20th century) at 1:10000, 1:10560, 1:2500 and 1:1250 scales;
- Tithe maps (and apportionments), estate maps and any other relevant historical maps within the relevant County Record Office (parts of Oxfordshire were formerly part of Berkshire and may still be covered by the Berkshire Record Office), or readily available elsewhere;
- English Place Name Society volumes or similar authoritative works covering place names of the study area;
- Geological maps of the study area;
- Geotechnical reports where such evidence is not being separately assessed;
- Previous archaeological evaluation and excavation records relating to sites in and immediately adjacent to the study area;
- Other published works, reports and information relevant to the desk-based assessment;
- Aerial photographic collections by Historic England Swindon and such other collections as are held by OCC within the HER for the area of study (beyond the specific development area);
- An assessment of any Lidar data held by the Environment Agency for the study area (beyond the specific development area);
- The Oxfordshire Historic Landscape Characterisation data (provided as part of the HER consultation);
- National Mapping Programme Data, where available;
- Portable Antiquities Scheme (PAS) data, available from the PAS website; and
- Regional research frameworks.

7.4.24 The designated and non-designated heritage assets within this assessment are identified with a unique identifier (e.g. [A1]). Assets referred to that are outside the formal study area will be referenced using their National Heritage List for England (NHLE) numbers (e.g. [NHLE: 1354687]). All assets are identified within the text and can be cross-reference to the gazetteer in Appendix 7.1 (where their HER or NHLE number, type, and short description are also listed). Cultural heritage assets are shown on Figures 2 and 3 in Appendix 7.2.

7.4.25 A site visit and setting assessment was undertaken on the 19th March 2020.

7.5 Assessment assumptions and limitations

Scheme design

7.5.1 The assessment has been based on the Scheme description presented in ES Chapter 2: The Scheme.

Baseline data and non-intrusive surveys

7.5.2 The assessment has been undertaken with reference to the baseline data, information and records pertaining to the historic environment derived from desk-based sources. These were subsequently validated and enhanced through field surveys where land access was obtained from landowners.

- 7.5.3 In areas where land access was unavailable as part of the walkover survey, site-based observations were made from public rights of way and other accessible areas.
- 7.5.4 Geophysical survey was carried out in areas not previously subject to archaeological investigation or disturbance that precludes the presence of archaeological remains. The results of the trial trench evaluation work are pending. It has been agreed with OCCAS on 2nd July 2021, that the archaeological evaluation report will be submitted as soon as possible. In the absence of the information from the archaeological trenching, for the purposes of this assessment a worst case scenario has been assumed that the Site has a high potential for as yet unknown archaeological remains to be present in areas not affected by modern activity (Figure 7.21 in Appendix 7.2).
- 7.5.5 The baseline data and records obtained are considered to be representative of the conditions that will exist at the point of commencing Scheme construction and the year of operation, as described in Section 7.7.
- 7.5.6 Where the assessment references a Zone of Theoretical Visibility (ZTV), the assessment is based on the ZTV defined in ES Chapter 8: Landscape and Visual, Figure 8.3 which includes details of the parameters used to define the ZTV.
- 7.5.7 All work was carried out during varying COVID 19 restrictions and full access to all sources were not available during the research for the baseline.

Construction Traffic Volumes and Routeing

- 7.5.8 During the Scheme construction phase, additional traffic will be directly generated by the construction works. The Early Contractor Involvement (ECI) appointed to provide reasonable assumptions on the likely works has provided an estimate of the numbers of HDVs and cars/ vans accessing the works at various points along the Scheme, on a monthly basis over the duration of the Scheme construction works. The distribution of the construction traffic across the surrounding road network has then been determined in the traffic assessment, focusing on 41 key links used in the transport assessment (ES Chapter 16: Transport, Figure 16.3) - these links have been also been used to inform the noise assessment (ES Chapter 10: Noise and Vibration). The assessment of impacts of construction traffic on cultural heritage assets is based on this reasonable assumption and the results of the traffic and noise assessments as reported in this ES.

7.6 Study area

- 7.6.1 DMRB defines a study area *“according to the sensitivity of the receiving environment and the potential impacts of the project”*. The guidance continues:

“Where a new road is proposed the study area shall include the footprint of the scheme plus any land outside that footprint which includes any heritage assets which could be physically affected.

The study area should include the settings of any designated or other cultural heritage resource in the footprint of the scheme or within the zone of visual influence or potentially affected by noise.

The study area used in the assessment shall be agreed with the Overseeing Organisation”

(DMRB, LA 106, 3.5 – 3.7).

- 7.6.2 Following consultation with OCCAS, the study area is confirmed as comprising the footprint of the Scheme and extends to 1km surrounding the Scheme for designated and non-designated cultural heritage resources in order to assess the potential effects of the Scheme on the assets and their setting. The assessment of assets where there may be changes to their setting as a result of Scheme beyond the 1km area has been considered. For this reason, the baseline technical appendix (Appendix 7.2) provides a baseline assessment and description of the full extent of Sutton Courtenay Conservation Area, and the full extent of the Nuneham Courtenay Grade I Registered Park and Garden and Conservation Area. In response to Historic England's Scoping Opinion, consideration has also been given to historic settlements outside the formal study area in relation to potential impacts caused through changes in traffic levels, for example at Abingdon and Nuneham Courtenay village. This flexible approach to defining the study area for assessment allows for the proportionate assessment of effects due to the Scheme.

7.7 Baseline conditions

Site description

- 7.7.1 The Scheme crosses a wide and varied landscape that encompasses agricultural fields, former industrial lands, quarries, landfill, the River Thames and its floodplain. The Site is located around the outskirts of several towns and villages, including Milton, Didcot, Appleford, Culham and Clifton Hampden. The following paragraphs describe the baseline within the defined study areas.

Overview of the historic environment

- 7.7.2 A total of 314 heritage assets were identified on the Oxfordshire HER, in the NHLE, and by the project team during preparation of this assessment. In addition, a total of 10 previous archaeological investigations have also been identified.
- 7.7.3 These assets are illustrated on Figure 2, 3 and 4 in Appendix 7.2 and comprise designated heritage assets, non-designated heritage assets, find spots and the sites of buildings which are not extant, dating from the Palaeolithic to the 20th century.
- 7.7.4 The assets have been collated and tabulated in Appendix 7.1. Where reference is made to individual assets within the chapter, a reference number in brackets has been added after the asset name which represents the reference number contained in Appendix 7.1 and attributed in the Desk-based Assessment Appendix 7.2 and on Figures 2 and 3.
- 7.7.5 For details of all cultural heritage assets the reader is referred to the Gazetteer of Cultural Heritage assets and Desk-based Assessment (Appendix 7.1 and Appendix 7.2 respectively). The cultural heritage assets described in this chapter are those with the potential to be impacted by the Scheme.

Designated assets

- 7.7.6 There are no designated assets within the Site. Impacts to designated assets are therefore assessed only in terms of impacts caused through change to their settings and how this affects their significance.
- 7.7.7 There are five Scheduled Monuments (SMs), one Registered Park and Garden, six conservation areas and 92 listed buildings within the study area.
- 7.7.8 There are no World Heritage Sites, Registered Battlefields or Protected Wrecks in the study area.

Scheduled Monuments

- 7.7.9 There is the potential for change to the setting of Scheduled Monument settlement site SM1006345 [A117] which contains around twelve overlapping rectangular enclosures and ditches with scattered pits, due to its proximity to the Scheme.

Registered Park and Garden

- 7.7.10 Part of one Registered Park and Garden lies within the study area; namely the Grade I Registered Nuneham Courtenay [A207]. It comprises an 18th century landscaped park and pleasure ground associated with the Grade II* listed Nuneham House and including Nuneham Courtenay Arboretum.

Conservation Areas

- 7.7.11 There are six conservation areas in the study area: at Milton, Sutton Courtenay, Culham, Didcot (Old) Town, Clifton Hampden and Nuneham Courtenay. These conservation areas represent several of the main settlement foci in the study area and each contain several listed buildings.

Listed Buildings

- 7.7.12 There are 92 listed buildings, including one listed at Grade I and six listed at Grade II* in the study area. Listed Buildings are generally clustered in the settlement foci, such as at Milton, Sutton Courtenay, Appleford, Culham, Didcot and Clifton Hampden, and within parkland at Nuneham Courtenay. Apart from Appleford, these areas are all designated as conservation areas, and Nuneham Courtenay has an additional designation as a Registered Park and Garden which covers a larger area than the conservation area. There are a small number of assets located outside these areas, generally these are associated with the Great Western Railway, such as the Grade II listed Railway Transfer Shed and Engine Shed [A65 and A66], south of Didcot railway station, and the Grade II* listed Culham Station, Ticket Office and Waiting Room [A209] and its associated Grade II listed Overbridge and Thame Lane Bridge [A160; A212], located east of Culham. Further isolated buildings include the Grade II listed Fullamoor Farmhouse [A161] and the Grade II listed Schola Europea [A155] and the former Diocesan training college north-east of Culham.
- 7.7.13 Apart from the Grade II* listed Culham Station, Ticket Office and Waiting Room [A209], the Grade I and II* listed buildings are located in the settlements of Milton, Didcot and Clifton Hampden. Milton contains the Grade I listed Milton Manor Cottage and Milton Manor House [A3], and the Grade II* listed Church of St Blaise [A4] and 42a and 42b High Street [A8]. Didcot contains the Grade II* listed Church of All Saints [A235]. Clifton Hampden contains the Grade II* listed Clifton Hampden Bridge [A178] and Church of St Michael and All Angels, High Street [A185].

Non-designated assets

- 7.7.14 Non-designated archaeological assets that will be impacted by the Scheme are detailed in Table 7.5.

Table 7.5: Non-designated archaeological assets within the Site

Asset No.	HER reference	Name/ Description	Type	Period	Significance (Heritage Value)
A54	PRN28911	Prehistoric activity and Iron Age/ Roman and Saxon settlements. 292 trench evaluation identified activity from Palaeolithic to post-medieval periods, including: 3 Iron Age and Roman settlement foci; probably early medieval sunken feature building; and medieval and/ or post-medieval/modern ridge and furrow cultivation, field drains and ditches	Ditch, double-ditched enclosure, field system, pit, posthole, ring ditch, grubenhaus, ridge and furrow	Iron Age, Roman, early medieval, medieval, post-medieval, modern	Medium
A60	PRN27496	Middle Iron Age and Roman settlement at Great Western Park. Middle Iron Age settlement covers an area c.10 hectare and includes roundhouses, enclosures, c.600 pits and large driveway. The majority of this asset has been removed through recent development.	Pit, Post built structure, roundhouse, settlement, trackway	Iron Age, Roman (400BC to 409AD)	Low
A36	PRN2838	Undated farmstead complex (probable Later Prehistoric to Roman date). Possible cropmark evidence of a farmstead complex of features, although there are indications that they are geological in origin.	Ditch, pit, rectangular enclosure, trackway	Unknown date (?later Prehistoric to Roman)	Medium
A142	PRN15315	Possible undated enclosure	Cropmark of possible undated enclosure	Unknown	Medium
A163	PRN5641	Undated enclosures and pits. Cropmark evidence of enclosures and pits, indicating possible settlement.	Enclosure, pit	Unknown date	Medium

7.7.15 An analysis of historic maps pertaining to the Site and study area, combined with the site walkover and setting assessment, identified one non-designated building within the Site and 13 non-designated buildings within the study area that are of historic interest. In contrast to the designated listed buildings, the non-designated buildings identified are generally isolated buildings beyond the area's settlement foci. Several isolated farms are recorded, and this is an asset type that does not feature as strongly in the area's designated assets. Only the non-designated building within the Site is considered further due to the inherent low sensitivity (heritage value) of this type of asset, resulting in only very limited potential for significant effects to arise to them.

- 7.7.16 The non-designated building within the Site is Hill Farm [A253] located to the south of Appleford. The farm is not mapped on the Appleford Tithe map of 1839, but a farm labelled as Hill Farm appears on the first edition 6" OS map dated 1883. The present buildings, however, relate to the farmstead as shown on the OS map of 1900 which captured the farm after redevelopment. The OS map of 1900 shows a loose courtyard farm with the farmhouse located across the lane to the west of the farmstead. The buildings that survive of this farmstead are two parallel linear ranges arranged east-west, with a short north-south aligned range between. The farmhouse and other parts of the farmstead have been demolished.

Historic Landscape

- 7.7.17 The Scheme crosses two Oxfordshire districts: the VoWHDC and SODC, which are predominantly rural, characterised by Enclosures, Woodland, and Rural Settlement. Within SODC enclosures are the most common broad type, at 71%, of which reorganised enclosures and prairie/ amalgamated enclosures are the most frequent (276). Within the district, industrial sites cluster around the towns and the River Thames. Within the VoWHDC enclosures are also the most common broad type, at 75%, of which reorganised enclosures cover more than a third of the District (280).
- 7.7.18 To the south of the River Thames, the Scheme crosses the following broad types: 'Enclosure', 'Civic Amenities', 'Industry' and 'Rural Settlement'. Within these, the following historic landscape character (HLC) types, the following are represented:
- Rural Settlement - Rural Farmstead (1811-1881);
 - Enclosure - Re-organised Enclosure (1921 – 1999);
 - Enclosure - Planned Enclosure (1811 – 1881);
 - Civic Amenities – Utilities;
 - Civic amenities – Waste Disposal;
 - Industry – Flooded Extractive Pits; and
 - Industry – Extractive Works.
- 7.7.19 Of these, the enclosures and rural settlement are located south of the A4130 and in a small land parcel north of Didcot. These are primarily reorganised enclosures created through the construction of the A4130, but also includes Rural Farmstead (HOX4964), which relates to the farmhouse and surrounding gardens of New Farm.
- 7.7.20 Elsewhere south of the River Thames, 'Civic Amenities' and 'Industry' dominate and are characterised by the former power station and landscapes created by gravel quarrying, which has resulted in areas of landfill and flooded extractive pits. These features now extend as far as the southern bank of the River Thames.
- 7.7.21 To the north of the River Thames, the Scheme crosses the following broad types: Enclosure, Industry, Woodland and Civic Amenities. Within these, the following HLC types, the following are represented:
- Enclosure - Re-organised Enclosure (1921 – 1999);
 - Enclosure - Re-organised Enclosure (1798 - 1810);
 - Enclosure - Planned Enclosure (1811 – 1881);
 - Industry – Industrial Estate (1960 – 1999);
 - Industry – Industrial Estate (1921-1999);
 - Woodland – Secondary (1921 – 1999);

- Woodland – Secondary (1700 – 1797); and
- Civic Amenities – Sewerage Treatment (1921 – 1999).

7.7.22 Of these, reorganised enclosures (1921-1999) and industrial estate dominate. At the northern end of the Scheme, the Site borders secondary woodland (1700 – 1797) (HOX 1085).

Construction Year Baseline (2023) and Opening Year Baseline (2024/25)

7.7.23 As detailed in ES Chapter 4: Assessment Methodology, a review has been undertaken to determine whether the existing baseline conditions might change between the time of undertaking the assessment and the future years in which the Scheme is planned to be constructed and become operational, as a result of future planned development.

7.7.24 Consideration was given to the following development-related changes that could potentially alter the historic environment in the future:

- The partial or total loss of known or potential buried archaeological resources within the Site or known above-ground assets within the study area as a consequence of land being disturbed or developed; and
- Changes to the sensitivity (value) and significance of assets within the study area through the introduction of new development in their setting.

7.7.25 The review evaluated the planned development projects summarised in ES Chapter 17: Cumulative Effects and involved:

- The identification of any permitted (i.e. consented) projects within the assessment study area that have yet to be implemented;
- Analysis of the likely environmental effects and planned timescales for each identified project; and
- An assessment of the potential for each identified project to change the existing baseline conditions in the Construction Year (2023) and Opening Year (2024/25), in the manner described above.

7.7.26 Although a small number of the development projects are expected to form part of, and influence, the future baseline conditions of the study area, the review concluded that there will be no material change to the form, character and appearance of the historic environment in year 2023 or the Scheme opening year 2024/25.

7.8 Potential impacts

7.8.1 The scoping exercise identified that the introduction and/ or modification of road infrastructure associated with the Scheme will potentially result in different types and durations of impact on cultural heritage, during both the construction and operational phases.

Construction

7.8.2 Temporary construction impacts lasting for all or part of the Scheme construction phase potentially include the following:

- The presence and movement of construction plant and equipment, which may impact on the significance of heritage assets caused by changes to their setting;

- The siting of construction compounds and activities within working areas, including associated construction noise and lighting, which may impact on the significance of heritage assets caused by changes to their setting; and
- The use of traffic management and increased volumes of traffic travelling on the local road network, which may impact on the significance of heritage assets caused by changes to their setting.

7.8.3 Permanent construction impacts lasting beyond the Scheme construction phase potentially include the following:

- Physical impacts on known heritage assets arising from construction activities such as earthworks excavation, the formation of construction compounds and the installation of drainage infrastructure;
- Physical impacts from essential mitigation such as landscaping and tree planting for screening;
- Physical impacts on landscapes of historical, cultural or archaeological significance as a consequence of construction, such as the loss of important elements of the landscape as a result of site clearance;
- Impacts caused by the presence of the Scheme within the settings of heritage assets;
- The disturbance, compaction or removal of previously unrecorded sub-surface archaeological deposits through construction activities; and
- Impacts on archaeological remains, historic buildings and the historic landscape associated with the introduction of the physical form and appearance of the Scheme in their setting.

Operation

7.8.4 Operational impacts of the Scheme potentially include the following:

- Changes to traffic movements (and associated vehicle lighting), which could affect the significance of heritage assets caused by changes to their setting;
- Changes in road noise from vehicle movements, which may affect the setting of heritage assets; and
- The operation of road lighting introduced as part of the Scheme, which may affect the setting of heritage assets.

7.9 Design, mitigation and enhancement measures

Embedded mitigation

7.9.1 Through the design-development process, the Scheme has been designed, as far as possible, to avoid effects on cultural heritage through option identification, appraisal, selection and refinement, as described in ES Chapter 3: Assessment of Alternatives.

Essential mitigation

7.9.2 Measures have been identified which will be implemented by the Principal Contractor (PC) to reduce the impacts and effects that construction of the Scheme has the potential to have on cultural heritage.

7.9.3 In relation to buried archaeological remains, the scope of mitigation required to record and evaluate known archaeological assets or preserve in situ of archaeological deposits of high significance where possible during construction will be informed by

the results of the desk-based research the geophysical survey, and trial trench evaluation.

7.9.4 The Outline Environmental Management Plan (OEMP) contains the recommendation for an Archaeological Management Strategy (AMS) that details the mitigation measures that will be undertaken prior to, and during construction of the Scheme. The measures detailed in the AMS will set out the required mitigation in a design brief following the submission of detailed drawings and the acceptance of the archaeological evaluation report with OCCAS and could include:

- Preservation of archaeological remains in situ;
- Protection of archaeological remains using fencing;
- Trial trench evaluation;
- A programme of archaeological investigation, recording and publication; and
- A programme of public archaeology and community engagement.

7.9.5 Construction of the Scheme will be subject to measures and procedures defined within the Construction Environmental Management Plan (CEMP), which will be produced prior to the commencement of construction by the PC and will be based on, and incorporate, the content and requirements of the OEMP and include the AMS.

7.9.6 The landscape design for the Scheme includes mitigation in the form of planting and placemaking throughout the Scheme extents aimed at reducing the visual impact of the Scheme in sensitive locations and creating enhanced access and a sense of place, where appropriate. Of relevance to this chapter is the proposed landscape strategy to the north of Clifton Hampden conservation area which aims to reduce the Scheme's impact on landscape amenity and the setting of the conservation area and the heritage assets it contains.

Enhancement measures

7.9.7 No opportunities for enhancement measures relating to cultural heritage were presented during the design of the Scheme.

7.10 Assessment of likely significant effects

7.10.1 In accordance with LA 104, assessment of impacts and effects (and their significance) on cultural heritage associated with construction and operation of the Scheme has taken account of the effectiveness of both the embedded and essential mitigation measures summarised in Section 7.9.

7.10.2 The assessment reports the temporary and permanent impacts and effects on those heritage assets that have the potential to be directly or indirectly affected by the Scheme by virtue of their proximity to the works, or through a shared relationship or setting.

Construction

7.10.3 The Scheme will physically impact five non-designated archaeological sites [assets A54, A60, A36, A142 and A163] within the Site through the removal of archaeological remains during Scheme construction (see Appendix 7.2).

7.10.4 Asset A54 (Figure 4, Sheet 2) is a large archaeological site encompassing prehistoric activity, Iron Age/ Roman and Saxon settlement identified through trial trench evaluation as part of the Valley Park Project, including: 3 Iron Age and Roman

settlement foci; a probable early medieval sunken feature building indicating Anglo-Saxon settlement activity; and medieval and/ or post-medieval/ modern ridge and furrow cultivation, field drains and ditches. The archaeological evidence present within the asset as a whole is considered to be of medium value. The Scheme will remove the northern end of the asset where trial trench evaluation has revealed limited archaeological remains comprising undated linear features and occasional ditches and pits dated to the various periods. No evidence of settlement was identified in the area that will be impacted by the Scheme. As such the Scheme will remove archaeological evidence that forms a minor part of asset A54 and will not substantially affect the archaeological value of the asset. The Scheme is therefore considered to have a minor impact on asset A54. The value of the asset is medium, the magnitude of impact is minor and the significance of effect on Asset 54 will therefore be slight adverse and permanent, and not significant. Essential mitigation in the form of archaeological investigation will reduce the significance of effect to neutral.

- 7.10.5 Asset A60 (Figure 4, Sheet 3) represents middle Iron Age and Roman settlement evidence at Great Western Park. The Middle Iron Age settlement covers an area c.10 hectare and includes roundhouses, enclosures, c.600 pits and large droveway. Asset A60 partially overlaps that of asset A54 assessed above and the area of A60 affected by the Scheme lies entirely within this overlap. Furthermore, the majority of A60 has been removed through past development. The archaeological evidence that remains attributed to asset A60 is considered to be of low value, the magnitude of effect is considered to be major as all of the remainder of A60 will be removed by the Scheme. The resultant significance of effect on asset A60 will therefore be slight adverse. Essential mitigation in the form of archaeological investigation will reduce the significance of effect to neutral.
- 7.10.6 Asset A36 (Figure 2, Sheet 3) comprises a possible undated farmstead complex (probable Later Prehistoric to Roman date) indicated by cropmark evidence, although there are indications that they are geological in origin. In the absence of the results of trial trench evaluation, the cropmarks are assumed to be archaeological in origin and assigned a sensitivity (heritage value) of medium. The Scheme will impact on the southern end of this cropmark complex resulting in the partial removal of the archaeological evidence represented by A36. This is assessed as a minor magnitude of impact. The resultant significance of effect will be slight adverse and permanent effect, and not significant. Essential mitigation in the form of archaeological investigation will reduce the significance of effect to neutral.
- 7.10.7 Asset A142 (Figure 4, Sheet 4) is a cropmark representing a possible undated enclosure of medium sensitivity (heritage value). The Scheme will impact the very southern end of this asset resulting in the partial removal of the archaeological evidence represented by A142. This is assessed as a minor magnitude of impact. The resultant significance of effect will be slight adverse and permanent effect, and not significant. Essential mitigation in the form of archaeological investigation will reduce the significance of effect to neutral.
- 7.10.8 Asset A163 (Figure 4, Sheet 7) comprises cropmark evidence of enclosures and pits, indicating possible settlement. In the absence of the results of trial trench evaluation the cropmarks are assumed to be archaeological in origin and assigned a sensitivity (heritage value) of medium. The Scheme bypasses the dense area of cropmark activity that lies to the south of the A415 Abingdon Road relating to this asset. The Scheme will therefore result in partial removal of the asset, assessed as a minor magnitude of impact on the archaeological value of the asset. The resultant significance of effect will be slight adverse and permanent, and not significant. Essential mitigation in the form of archaeological investigation will reduce the significance of effect to neutral.

- 7.10.9 In the absence of the results of trial trench evaluation, in addition to the known assets assessed above, the Site is considered to have a high potential for as yet unknown archaeological remains to be present in areas that have not been affected by modern activity (Figure 21). If present and in the absence of baseline information from trial trench evaluation any such remains is unknown and could be of up to high sensitivity (heritage value). There is a risk that archaeological deposits of high significance requiring physical preservation could be encountered. At present the Scheme is assessed to have a major impact on potential remains through their removal during construction. In the absence of information from trial trench evaluation and for the purposes of this assessment the Scheme is therefore considered to have a potential large adverse significance of effect on as yet unknown archaeological remains within the Site. Essential mitigation in the form of archaeological investigation will reduce the significance of effect to moderate. This is considered to be significant.
- 7.10.10 The potential for impacts to designated and non-designated assets within the study area as a result of change to their settings during construction have been identified (see Appendix 7.2). These impacts may derive from temporary construction-related activities such as noise, lighting and vehicle movements, together with the permanent presence of the Scheme within the setting of the asset.
- 7.10.11 Several assets were scoped out of further assessment due to the lack of potential for significant effects resulting from the Scheme (see Table 5.10 in Appendix 7.2). The following 10 designated and non-designated assets are those where it is considered that there is the potential for an impact.

Asset A117 – Settlement site SM1006345 (Figure 4, Sheet 4)

- 7.10.12 Comprising around twelve overlapping rectangular enclosures and ditches with scattered pits. The monument's heritage interest lies primarily in its archaeological value in providing evidence of prehistoric land-use. The monument's location adjacent to the River Thames indicates that it was intrinsically linked to the river. The river provides a natural boundary to the southern limit of the archaeological remains that the monument encompasses and will have provided communication and possible trading links up and down stream for the enclosures that the monument encompasses. The River Thames provides a path of connectivity both upstream and downstream to other monuments, therefore, forming a key part of the setting of A117, together with contemporary monuments in the surrounding landscape. The links downstream have been severed by the existing railway embankment to the immediate east, as has its relationship with other monuments to the east. Looking west and south the landscape has been affected by relatively recent activity by quarrying and other modern development (Figure 21).
- 7.10.13 The Scheme will maintain the monument's relationship with the River Thames, whilst further enclosing and isolating the monument on the west. As the monument's heritage interest (sensitivity) lies primarily in its archaeological value, the change to its setting from the Scheme is considered to be a minor impact and permanent. The sensitivity of A117 is high. The resultant effect will be slight adverse and permanent, and not significant.

Nuneham Courtenay Registered Park and Garden [A207] (Grade I) and the listed buildings therein (see Appendix 7.2 Table 5.1)

- 7.10.14 Nuneham Courtenay Registered Park and Garden [A207] is a Grade I designated asset of high value. The value of the asset lies in its historic, architectural and artistic interests as an 18th century designed landscape with a high degree of survival and which has notable associations with key national figures in architecture and landscape architecture of the 18th and 19th centuries, including Lancelot 'Capability'

Brown. To a lesser degree it also has archaeological interest in the buried remains of Nuneham village, within the park as well as any parts of the park that may have been lost, altered or overgrown in the course of the last two centuries. The view from the asset towards the Scheme is represented by Viewpoint 40 of the LVIA presented in ES Chapter 8: Landscape and Visual (see Figure 8.55).

- 7.10.15 The setting of the garden includes its siting, approaches and carriage drives, as well as its designed key views. The setting assessment provided in Section 5.2.17 of Appendix 7.2 highlights that the designed views within the garden looking outward were focused to the west and north of the garden over the Thames towards Abingdon and over the countryside towards Oxford, respectively. Nuneham House [NHLE 1286179], the Grade II* listed residence within the parkland, likewise faces westward, with Grade II listed terraces present on the west and north, as well as the south side of the building overlooking the parkland [NHLE 1048045]. Within the garden, views were inward looking along its drives and footpaths. Thick woodland was noted along the south and south-east side of the garden, screening views inward and outward on this side. Outside the garden the landscape comprises generally open countryside, except at CSC.
- 7.10.16 Within the setting of the asset, the Scheme includes the Clifton Hampden Bypass which will be constructed to the south-east of the park between it and Clifton Hampden. This includes the bypass, adjacent cycle and footway, and grass verges, as well as landscaping to the north and north-west of Clifton Hampden (see Preliminary Landscape Masterplan ES Chapter 8: Landscape and Visual Figures 8.72r and 8.72s). The proposed bypass at Clifton Hampden crosses a lane that runs parallel to Thame Lane at the perimeter of CSC. Realignment of part of this lane is proposed with the creation of a crossroads with priority given to traffic on the bypass. This lane was created after the establishment of the former airfield and is not associated with the designed park.
- 7.10.17 The impacts of the construction of the bypass and its presence in the landscape to the south-east of the park will change the character of the setting of the park and garden and impact on the character of the approach to the park. Views of this area are represented by Viewpoints 35 and 38 of the LVIA presented in ES Chapter 8: Landscape and Visual (see Figures 8.50 and 8.53). There will be no direct views of the Scheme from within the park, or from listed buildings within the park, although there is the possibility of glimpsed views in traveling through the park. The Zone of Theoretical Visibility (ZTV) (see ES Chapter 8: Landscape and Visual, Figure 8.3) demonstrates the degree of screening provided by the woodland along the park's south and south-eastern boundaries. The Scheme will not feature in key designed views, and it will not feature in key views towards the park, or in the original approaches to the park. The south-eastern side of the park is heavily wooded and the link between the park and the surrounding landscape on this side is a minor element of its setting, which has already been altered with the establishment of CSC. The construction and presence of the bypass in the setting of the park will continue the urbanising effect of the presence of CSC this side, building on and reflecting this character, and therefore altering the current agricultural setting of the park that is present to the east of CSC. Whilst this change will be perceptible, it is considered that the change will alter one minor aspect of the setting of the asset, which is focused in an area that is not a key part of the setting and which has already experienced a degree of change. The impact of the Scheme on Nuneham Courtenay Registered Park and Garden is therefore assessed as negligible, resulting in a slight adverse effect and permanent, which is not significant.

Nuneham Courtenay Conservation Area [A225] and the listed buildings therein (see Appendix 7.2 Tables 5.1 and 5.7)

- 7.10.18 Nuneham Courtenay Conservation Area [A225] is a designated asset of high value. It covers much of the same area as the Registered Park and Garden [A207], although the conservation area excludes the land parcel west of Furze Brake which is included within the boundary of the park and garden, and includes Nuneham Courtenay village to the north-east of the park, which is excluded from the park and garden.
- 7.10.19 With regards to the heritage value of the conservation area, the value is considered to be high and derived from the same historic, architectural and artistic interests, together with archaeological interest in the buried remains of the original Nuneham Courtenay settlement within the park. The conservation area has additional historic and architectural interest including the extent of the re-established planned village of Nuneham Courtenay on approach to the park, containing 25 Grade II listed buildings. The setting of the conservation area is the same as the Registered Park and Garden and includes its siting, approaches and carriage drives, as well as its designed key views.
- 7.10.20 The setting assessment provided in Section 5.2.17 of Appendix 7.2 highlights that the designed views within the garden looking outward were focused to the west and north of the garden over the River Thames towards Abingdon and over the countryside towards Oxford, respectively. Nuneham House [NHLE 1286179], the Grade II* listed residence within the parkland, likewise faces westward, with Grade II listed terraces present on the west and north, as well as the south side of the building overlooking the parkland [NHLE 1048045]. Within the garden, views were inward looking along its drives and footpaths. Thick woodland was noted along the south and south-east side of the garden, screening views inward and outward on this side. Outside the garden the landscape comprises generally open countryside, except at CSC. One area where the setting of the conservation area differs from the setting of the Registered Park and Garden is in the area west of Furze Brake. This area falls within the park, but forms part of the setting of the conservation area as it falls outside its boundary. It provides a larger buffer area in the landscape between the designated area and CSC.
- 7.10.21 The view from the asset towards the Scheme is represented by Viewpoint 40 of the LVIA presented in ES Chapter 8: Landscape and Visual (see Figure 8.55). The Clifton Hampden Bypass is within the landscape setting of the conservation area. The features of this section of the Scheme within the setting of the conservation area also includes a cycle and footway, grass verges, and landscaping to the north and north-west of Clifton Hampden - see Preliminary Landscape Masterplan ES Chapter 8: Landscape and Visual Figures 8.72r and 8.72s.
- 7.10.22 As with the assessment of the park, the impacts arising from the Scheme are linked to the construction and presence of the Scheme within the agricultural setting of the area and change to the character of this part of the setting and the approach to the park. Views of this area are represented by Viewpoints 35 and 38 of the LVIA presented in ES Chapter 8: Landscape and Visual (see Figures 8.50 and 8.53). The construction and presence of the bypass within the setting of this side of the park will continue the urbanising effect resulting from the presence of CSC, building on and reflecting this character, and therefore altering the current agricultural setting of this side of the park. Whilst this change will be perceptible, it is considered that the change will alter one minor aspect of the setting of the asset, focused in an area that is not a key part of the setting and which has already experienced a degree of change. The village of Nuneham Courtenay, within the conservation area, is outside the formal study area for this assessment and outside the area for detailed traffic assessment. No significant changes to traffic volumes are predicted for this settlement (see ES

Chapter 16: Transport) and no impact to the value of listed buildings in this settlement are predicted. The impact of the Scheme is therefore assessed as negligible, resulting in a slight adverse effect and permanent, which is not significant.

Clifton Hampden Conservation Area [A224] and the listed buildings therein (see Appendix 7.2 Table 5.1)

- 7.10.23 Clifton Hampden Conservation Area [A224] is a designated asset of medium value. The value of the asset lies in its architectural and historical interest as an early-medieval settlement centred on a rise overlooking the River Thames, with a linear plan form demonstrating how the village grew along two routeways leading from the river crossing. Architectural and historic interest is provided by individual buildings and their group value with each other. Some have an important association with Sir George Gilbert Scott, and the area also featured in the classic work *Three Men in a Boat (To Say Nothing of the Dog)*, written by Jerome K. Jerome in 1889.
- 7.10.24 The setting assessment noted that the boundary of the conservation area includes the built form of the settlement together with fields to the rear of buildings defining it as rural settlement. The river and the rural character of the approaches to the conservation area contribute to its value. The approaches feature tree-lined and hedge-lined roads, where open-aspect views are also a strong feature, across farmland that emphasises the rural setting of the conservation area. The assessment noted that views from outside the settlement seldom feature any of its buildings, however, from higher ground to the north of the settlement, a view of the steeple of the Grade II* listed Church of St Michael and All Angels [A185] can be achieved where it is nestled in the mature trees along the river valley (see Photo19 in Appendix 7.2).
- 7.10.25 Views of this area are represented by Viewpoints 31-34, and 36-38 of the LVIA presented in ES Chapter 8: Landscape and Visual (see Figures 8.46-8.49 and 8.51-8.53) that include views from the conservation area towards the Scheme and from within the setting to the north and west of the conservation area. A night-time view is also presented for Viewpoint 36 within the conservation area in ES Chapter 8: Landscape and Visual (see Figure 8.70) which notes the dark character of the both the conservation area and its setting to the north.
- 7.10.26 The Scheme in the vicinity of the conservation area comprises Clifton Hampden Bypass which begins on Abingdon Road at the south of CSC and travels north-easterly to the west and north sides of the conservation area, and onto the B4015 Oxford Road heading westward. The bypass will tie-in with the current alignment of the B4015 Oxford Road (east) and a T-junction with a ghost island right turn will be included, to provide access to the current alignment of the B4015 Oxford Road (south-west). The Preliminary Landscape Masterplan (see ES Chapter 8: Landscape and Visual Figures 8.72r and 8.72s) outlines screening and placemaking features in this area. The proposed tree planting to the north and west of the conservation area boundary reflects the outline of areas of woodland shown on 19th century OS maps, except moved further north and westward than their historic extent, as those formerly wooded areas have since been built upon. The re-establishment of this woodland setting on the north and west of the conservation area is therefore in keeping with its historic appearance, whilst also providing necessary screening of the Scheme in views within the setting of the conservation area. The newly realigned section of Oxford Road is proposed to have a relatively open aspect to both sides providing views across fields and amenity areas and up to existing hedgerows. This reflects the current rural character of the approaches to the conservation area.
- 7.10.27 The impacts of the construction and presence of the Scheme in the setting of the conservation area are related to changes to the northern approach, and changes to the character of the rural setting of the conservation area on the north and west sides.

The Scheme will continue the urbanising effect of the presence of CSC to the west of the conservation area, building on and reflecting this character, and therefore altering the current agricultural setting that is present to the east of CSC. The Preliminary Landscape Masterplan reflects the historic character of the conservation area, which has been historically researched. The bypass and the screening planting will also not interfere with the view towards the steeple of the Grade II* listed Church of St Michael and All Angels [A185] from the north, due to the local topography in this area, whereby the bypass will sit within a dip in the foreground with the view oversailing the bypass and screening planting, towards the steeple. This is a daytime view, so night-time lighting/ glow will not affect appreciation of it. No impacts are predicted in relation to other individual buildings within the conservation area, as their settings are inward looking and unaffected by changes outside the northern and western boundary of the conservation area. The construction and presence of the Scheme within the setting of the conservation area is assessed as having a minor impact, resulting in a slight adverse effect, which is not significant. This effect will be of temporary duration, until the planting for screening proposed in the Preliminary Landscape Masterplan has matured (ES Chapter 8: Landscape and Visual Figures 8.72r and 8.72s). After this point the impact will reduce to negligible, resulting in a neutral effect, which is not significant.

Culham Station and Ticket Office [A209] (Grade II) and Culham Station Overbridge [A160] (Grade II)*

- 7.10.28 The Grade II* listed Culham Station and Ticket Office [A209] and the Grade II listed Culham Station Overbridge [A160] are assets of high value. They are discussed together here due to their functional association and shared setting. The value of the assets is derived from their architectural and historical value as part of the Great Western Railway and their association with Brunel. The station is a rare survival of a Brunel designed station and it is the only surviving example of a station built to this particular design. The setting of the station and overbridge is informed by their relationship with each other and their relationship with the railway line and other non-designated buildings found in combination with them, namely; the Railway Hotel [A262], Railway Cottages [A263] Semi-detached houses [A264]. The assets are in an enclosed area, with mature planting, generally screened from view of Abingdon Road to the south, and CSC to the west. This enclosed character contributes to understanding of the assets as a collection of buildings forming a rural station. Views in this area are represented by Viewpoint 26 of the LVIA presented in ES Chapter 8: Landscape and Visual (see Figures 8.41). Near the assets, the Scheme includes a new roundabout, to the east, to facilitate access to CSC and a series of attenuation ponds. The Preliminary Landscape Masterplan (see ES Chapter 8: Landscape and Visual Figure 8.72p) includes landscaping at the new junction where the strategy proposes retention of the existing mature planting west of the listed buildings that presently screens it from view. The retention of this existing planting will continue to effectively screen the construction and presence of the Scheme from the assets. This, combined with the Scheme taking place within an area already significantly changed by the presence of CSC, means that there are no impacts predicted to the station and overbridge. This results in a neutral effect, which is not significant.

Fullamoor Farmhouse [A161] (Grade II)

- 7.10.29 The Grade II listed Fullamoor Farmhouse [A161] is an asset of high value. The value of the farmhouse is derived from its architectural and historical value as a good example of 17th and 18th vernacular domestic architecture. The setting of the farmhouse comprises its courtyard and garden and the surrounding agricultural landscape to the south, west and east that contributes to understanding of its former function as a farmhouse. This understanding is eroded somewhat through the loss of the historic farmstead ranges that were previously located in the courtyard to the

north of the farmhouse. Beyond the former farmstead, the farmhouse is accessed via Abingdon Road. Historically the farm's landholding extended beyond Abingdon to the north, although there was not a visual connection between that land and the farmhouse due to the intervening farmstead buildings. The land to the north of Abingdon Road is no longer farmland, having first been adapted for use as part of the airfield, and subsequently developed as CSC. The land now reads as amenity landscaping associated with CSC. There are mature trees within the land to the north and on the northern boundary of the farmhouse's plot that screen views between the farmhouse and the Site. Views in this area are represented by Viewpoints 27 and 28 of the LVIA presented in ES Chapter 8: Landscape and Visual (see Figures 8.42 and 8.43). The area provides a historic route of approach to the farmhouse with an overall green character formed by the amenity landscaping to CSC, making a very limited contribution to the heritage value of the asset as a rural farmhouse. Near the asset, the construction and presence of the Scheme includes a new roundabout, to the north-west, to facilitate access to CSC and the realigned A415 on embankment. There will also be a series of attenuation ponds and the existing A415 will become a cycleway and access lane to Fullamoor Farmhouse. The Landscape Masterplan (see ES Chapter 8: Landscape and Visual Figure 8.72p) proposes that the existing hedge to the north side of Abingdon Road will be replanted with native species hedgerow with trees, and the surrounding area will be species rich grass interspersed with trees and ornamental shrub and bulb planting, some of which are retained existing planting. The area currently reads as amenity landscaping associated with CSC and this overall character will be unchanged as a result of the Scheme, with the new landscaping scheme also reading as amenity landscaping associated with CSC and the road and roundabout. Summer and winter photomontages of the Scheme from Viewpoint 27 of the LVIA are presented in ES Chapter 8: Landscape and Visual (see Figure 8.87). The construction and presence of the Scheme in the setting of the asset will have a slightly urbanising effect due to the scale and type of the Scheme, but this takes place within an area of the asset's setting that is already significantly changed. The construction of the Scheme is therefore viewed as having a negligible impact, resulting in a slight adverse and permanent effect, which is not significant.

Hill Farm [A253] (non-designated)

- 7.10.30 Hill Farm [A253] is a non-designated asset of low value. The buildings derive their heritage value from their historic and architectural interest as examples of late-19th vernacular farm buildings. Their value is lessened by later alterations to the buildings and the loss of parts of the farmstead and the farmhouse. The setting of the buildings is dominated by the current use of the farmyard for aggregate storage and transportation; farmland to the west and north of the building has been subject to abstraction. The setting of the asset does not therefore make a significant contribution to its value. To the immediate west of the asset the Scheme will include the introduction of footpath and cycleway, improvements to the road, and the introduction of a signalised crossing. To the south of the asset a new road link section will be created to link to a future development area east of the asset. The construction and presence of the Scheme in the setting of the asset will have an urbanising effect, changing the character of the road from a rural lane to a signalised road flanked by footpaths and cycleways. The road has already undergone some change, with a bunded abstraction area present along its western side. The change is therefore viewed as having a negligible impact, resulting in a slight adverse and permanent effect, which is not significant.

New Hill Farm [A252] (non-designated)

- 7.10.31 New Farm [A252] is a non-designated asset of low value. The farmstead derives its heritage value from its historical and architectural interests as a largely complete example of a mid- to late-19th century planned farmstead. The setting of the farmstead

has always featured the Great Western Railway running east-west a short distance to the north of the buildings, and it is now flanked by the A4130. The farmland was therefore most likely focused on the land to the east, south and west of the farm. Except for the A34 within its former farmland, the surroundings have remained largely undeveloped and the agricultural character of the setting contributes to the understanding of the asset. The road and railway to the north of the asset form the limit of its setting on that side. Near the asset, the Scheme includes the introduction of Backhill Roundabout to the west and the widening of the A4130 to the north, including a low embankment on its south side. Views in this area are represented by Viewpoints 2 and 3 of the LVIA presented in Chapter 8: Landscape and Visual (see Figure 8.17-8.18). The proposed Backhill Roundabout will occupy part of the agricultural setting of the farmstead, and the road widening to the north will bring the road slightly closer to the asset on that side. The construction and presence of the Scheme within the asset's setting is therefore assessed as having a minor impact, resulting in a slight adverse and permanent effect, which is not significant.

Appleford Crossing Cottage [A255] (non-designated)

- 7.10.32 Appleford Crossing Cottage [A255] is a non-designated asset of low value. The value of the building is derived from its architectural and historic interest as part of the infrastructure of the Great Western Railway. Its designer and construction date are not known, however, so a link with Brunel as a possible designer cannot be established. The architectural interest is severely diminished by alterations that have taken place in recent years, however the historic interest as part of the railway remains. This interest is informed by the setting of the asset adjacent to the Appleford level crossing. Near to the asset, the Scheme includes widening of the road to the west. Views from this area are represented by Viewpoints 10 and 11 of the LVIA presented in ES Chapter 8: Landscape and Visual (see Figures 8.25 and 8.26). Despite their proximity, these alterations will cause no impact to the heritage value of the asset, and the effect therefore neutral.

Zouch Farm [A260] (non-designated)

- 7.10.33 Zouch Farm [A260] is a non-designated asset of medium value. The farmhouse and remaining farm buildings have heritage value derived from their architectural and historic interest as an example of a large planned late-Georgian and early Victorian farm and separate farmhouse. The setting of the farm is its garden to the south of the farmhouse and the agricultural land that surrounds it on all sides. The railway is a feature within the setting of the asset, forming a boundary to its farmland on the east side, with the railway bridge over the River Thames to the south and visible from within its grounds. To the north, Abingdon Road is the main access point into the farm and has always been a feature of the setting. In the vicinity of the asset the Scheme will include alterations to Abingdon Road to the north, with the addition of a footway and cycleway to the south side of the road and the creation of a splayed access and raised crossing at the access into the asset. Views in this area are represented by Viewpoint 24 of the LVIA presented in ES Chapter 8: Landscape and Visual (see Figure 8.39). Whilst these features will change the setting of the asset on approach, they will not result in any change to the heritage value of the asset and therefore no impact is predicted. This results in a neutral effect.

Coppice House [A265] (non-designated)

- 7.10.34 Coppice House [A265] is a non-designated asset of low value. The farmhouse and farmstead have heritage value derived from their historic and architectural interests as a 19th century farm, although this is diminished by the conversion of the farm buildings. The boundaries of the property, to the east and south comprise a dense screening of mature trees, whilst there is a more open aspect to the west. Still, the

buildings are not visible in views from within the wider landscape due to the screening effects of vegetation and the local topography. To the north, the property boundary meets the dense woodland on the southern boundary of Nuneham Courtenay Park. The landscape outside the property boundary therefore makes little contribution to its significance. In the vicinity of the asset, the Scheme will include the introduction of the Clifton Hampden Bypass and alterations to Oxford Road to the south of the asset, including the realignment of the access road leading into Clifton Hampden and associated attenuation ponds and landscaping. The view from this asset towards the Scheme is represented by Viewpoint 38 of the LVIA presented in ES Chapter 8: Landscape and Visual (see Figure 8.53). Whilst these features will change the setting of the asset on approach, they will not result in any change to the heritage value of the asset and therefore no impact is predicted. This results in a neutral effect.

Historic Landscape Character

- 7.10.35 The Scheme traverses several historic landscape character types, and the majority of these are the result of recent landscape change (see Appendix 7.2). A key feature of the landscape through which the Scheme passes is change. The sensitivity to change of the historic landscape character types, through which the Scheme passes, is therefore considered to be low. The impact on historic landscape character is assessed as negligible adverse and the resultant significance of effect is neutral.

Operation

- 7.10.36 The impacts to designated and non-designated assets during the operation of the Scheme are as a result of change to their settings. These impacts may be derived from changes to traffic volumes and patterns of movement, operational noise and operational lighting.
- 7.10.37 The assessment has determined that there will be no operational impacts to archaeological assets or historic landscape character.
- 7.10.38 Operation of the Clifton Hampden Bypass will take traffic away from the centre of the Clifton Hampden Conservation Area [A224], with a projected 50-60% reduction of traffic through the area (see ES Chapter 16: Transport). This is assessed as a beneficial impact of the Scheme which will improve understanding of the conservation area as a rural settlement and allow for greater appreciation of its architectural and historic interests, including those of its individual designated and non-designated buildings (see Tables 5.2 and 5.3 of Appendix 7.2). Operational lighting is not considered to result in any impact to the significance of the conservation area since the proposed lighting at the Clifton Hampden Bypass includes all non-motorised user (NMU) facilities and the southern roundabout. The lighting is also proposed to be dimmed to 75% between 0.00 and 06.00 (see ES Chapter 2: The Scheme). This will maintain the dark character of the asset's setting which contributes to understanding of it as a rural settlement. The impact on the Scheme upon the conservation area is therefore assessed as negligible, which results in a slight beneficial effect to the conservation area and the designated and non-designated assets it contains. This is not significant.
- 7.10.39 Further operational beneficial effects are also anticipated at Sutton Courtenay Conservation Area and Culham Conservation Area, both of which are assets of medium value, that contain listed buildings of high value, and at Elm Hayes Grade II listed building [A78], in Appleford, which is an asset of high value. In these locations the Scheme will result in a 30-40% reduction in traffic (see ES Chapter 16: Transport) with associated reductions in noise levels (see ES Chapter 10: Noise and Vibration, Figure 10.5). This will improve understanding of the conservation areas as rural settlements and allow for greater appreciation of their architectural and historic

interests, including those of their individual designated buildings. At Elm Hayes the reduction in traffic volume will also improve understanding of the asset as a rural vernacular cottage. These benefits are assessed as negligible, resulting in slight beneficial effects to Elm Hayes, the conservation areas and the designated assets they contain. This is not significant.

7.10.40 Nuneham Courtenay Grade I Registered Park and Garden [A207] and conservation area [A225] are assets of high value. Operational lighting is not considered to result in any impact to the significance of the park since the proposed lighting at the Clifton Hampden Bypass include all NMU facilities and the southern roundabout. The lighting is also proposed to be dimmed to 75% between 0.00 and 06.00 (see ES Chapter 2: The Scheme). The operational noise assessment carried out in ES Chapter 10: Noise and Vibration, assessed a representative point where the boundary of the park is at its closest to the Scheme, as a worst-case assessment. It also provided qualitative commentary on the likely noise impacts at the Grade II listed Venison House [A206] and Gamekeeper's Cottage [A205] within the park as the closest parkland buildings to the Scheme, noting that the Grade II* listed Nuneham House [NHLE: 1286179], within the park, is outside the formal area for assessment and further from the Scheme than the Venison House and Gamekeeper's Cottage. This concluded that at the point where the park is closest to the Scheme there will be a minor increase in noise in the short and long term. Further east Nuneham Park extends up to the B4015 where moderate increases in noise levels are predicted in the long term only in a very small area (minor in short term), this is due to anticipated traffic growth on the B4015 in the long term, which connects onto the north-east end of the Scheme, from other developments in the area. The vast majority of Nuneham Park, including the Venison House and Gamekeeper's Cottage, is much more remote from the Scheme and therefore the impact is considered to be negligible. As a parkland and Registered Park and Garden [A207] and conservation area [A225] are considered to be sensitive to aural intrusion in terms of their heritage value. This negligible increase in noise levels within the parkland is therefore assessed as a negligible impact on this asset, resulting in a slight adverse effect and permanent, which is not significant. This impact will be felt in combination with the permanent slight adverse effect resulting from the presence of the Scheme within the asset's setting, this is not considered to increase the level of impact or the significance of effect beyond slight adverse. No operational impacts to the heritage value of individual listed buildings within the parkland are anticipated.

7.10.41 The Grade II listed Fullamoor Farmhouse [A161] is an asset of high value. Night-time views in this area are represented by Night Viewpoint 27 of the LVIA presented in ES Chapter 8: Landscape and Visual (see Figures 8.69a and 8.69b). This demonstrates that there is lighting along the existing A415, and at the entrance of the CSC. The latter is filtered by existing vegetation, with some sky glow evident. Car headlights and taillights are visible along the existing A415, which is a fairly busy route. The addition of the operational lighting to this existing lighting will increase the urbanising influence of the existing lighting in the land to the north of the farmhouse. This will, however, be dimmed to 75% between 0.00 and 06.00 (see ES Chapter 2: The Scheme). The urbanising effect of the operational lighting will be felt in combination with the permanent slight adverse effect resulting from the presence of the Scheme within the asset's setting. Given the existing lighting in this area, this is not considered to increase the level of impact or the significance of effect beyond slight adverse. The operational noise assessment (ES Chapter 10 Noise and Figure 10.5) concludes that the farmhouse is located to south of the A415 which is a major road that is bypassed by the scheme in this location. Therefore, in the opening year there will be a beneficial impact ranging from minor to major decrease in noise levels depending on the façade/floor. In the long term this impact ranges from negligible change to moderate decrease in noise levels. Whilst this is not considered to affect the heritage value of

the asset, it demonstrates that the Scheme will not worsen noise levels within the asset's setting.

7.11 Monitoring

Construction effects

- 7.11.1 As the assessment has concluded that there will be potential significant adverse effects arising from construction of the Scheme, monitoring of the measures identified to mitigate these effects will be undertaken to ensure their successful delivery. The results of the trial trench evaluation will confirm whether there will or will not be significant adverse effects from the construction of the Scheme.
- 7.11.2 The archaeological mitigation works (including protection measures for heritage assets and preservation in situ of archaeological remains) will be undertaken during the advanced works (most of the archaeological fieldwork and recording) and construction works stages.
- 7.11.3 Details of the monitoring required during the construction phase will be provided in the AMS, the parameters and duration of which will be proportionate to the nature, location and size of the Scheme and the significance of its effects on identified heritage assets. The AMS will be developed in consultation and agreed with the OCCAS. Essential mitigation measures included in the AMS could include:
- Preservation of archaeological remains in situ;
 - Protection of archaeological remains using fencing;
 - Trial trench evaluation;
 - A programme of archaeological investigation, recording and publication; and
 - A programme of public archaeology and community engagement.
- 7.11.4 An Archaeological Clerk of Works (ACoW) (to be employed by the PC) will be responsible for monitoring the implementation of the AMS in consultation with the OCCAS who monitor the archaeological works on behalf of the planning authority to ensure compliance with planning conditions and in line with the standards and guidance of the ClfA (Ref 7.21). This will include:
- Monitoring of fencing to ensure its condition and signage;
 - Monitoring of preservation in situ measures; and
 - Monitoring of the archaeological mitigation works to ensure they are in line with the requirements of the AMS provided in a Site-Specific Written Scheme of Investigation (SSWSI) to be prepared by the PC's archaeological contractor.
- 7.11.5 As there are no significant effects related to the setting of heritage assets, no monitoring is proposed.

7.12 Assessment of harm

- 7.12.1 Within the NPPF, impacts affecting the value of designated heritage assets are considered in terms of harm. Paragraph 199-202 introduce the requirement to determine whether the level of harm amounts to 'substantial harm' or 'less than substantial harm'. There is no direct correlation between the significance of effects identified through the EIA process as reported herein and the level of harm caused to heritage significance. Therefore, the following statement of harm is provided to align the results of this assessment with the requirements of NPPF. The assessment

of harm arising from the impacts of the Scheme has been determined in accordance with relevant Historic England and ClfA guidance and using professional judgement.

- 7.12.2 The Scheme will impact the setting of the Scheduled Monument (A117, SM1006345) and cause less than substantial harm.
- 7.12.3 The Scheme will cause less than substantial harm to the Grade I Registered Park and Garden at Nuneham Courtenay [A207] and the Nuneham Courtenay Conservation Area [A225] through change to their settings. This harm is at the low end of less than substantial, due to it being focused in areas that are not within key designed views towards or from the parkland, or on its approaches. No harm will be caused to the individual listed buildings within these areas.
- 7.12.4 In the absence of results from trial trench evaluation, the potential impact on as yet unknown archaeological remains have been assessed as being moderate adverse and permanent. Given the limited width of the Scheme, it is likely to remove only a limited portion of any as yet unknown archaeological remains that may be present and so is assessed as causing less than substantial harm to as yet unknown archaeological remains.
- 7.12.5 Paragraph 203 of the NPPF deals with impacts to non-designated heritage assets, stating that the determination of an application should take into account the scale of any harm or loss and the significance of the asset. The impact assessment provided in Section 7.10 above provides information on the scale of impact and the significance of effects on non-designated assets and this correlates directly with the requirements of Paragraph 197.

7.13 Summary

- 7.13.1 The assessment has determined that there will be no significant effects on known archaeological assets within the study area as a result of the Scheme.
- 7.13.2 In the absence of results from trial trench evaluation the Scheme is assessed to have a potential significant adverse effect on as yet unknown archaeological remains which may be present.
- 7.13.3 There will be no significant effects on the historic landscape character of the study area as a result of the Scheme.
- 7.13.4 There will be no significant effects on designated and non-designated built heritage assets as a result of the Scheme.

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Annex 3 – Appendix 7.2: Cultural Heritage Desk Based Assessment



REVISED

Didcot Garden Town HIF 1 Scheme

Environmental Statement

Volume III

Appendix 7.2 – Cultural Heritage Desk-Based
Assessment

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1. Introduction

- 1.1.1 This Technical Appendix supplements ES **Chapter 7: Cultural Heritage** (ES Volume 1) and describes the additional details for the assessment of impacts to designated and non-designated heritage assets.
- 1.1.2 This cultural heritage desk-based assessment (CHDBA) was undertaken by AECOM on behalf of Oxfordshire County Council (OCC). The purpose of the CHDBA is to inform the Environmental Impact Assessment (EIA) for the proposed Didcot Garden Town HIF1 Scheme (herein referred to as 'the Scheme') for which a Planning Application is to be submitted in 2021.
- 1.1.3 The CHDBA establishes baseline information regarding cultural heritage within a defined study area of 1 km surrounding the Scheme boundary (herein referred to as 'the Site'); identify key constraints; assesses the archaeological potential of the study area and provides an understanding of the application site within its wider heritage context to inform the assessment of significance of the heritage resources.
- 1.1.4 Heritage resources in this context means the above and below-ground archaeological resource, built heritage, the historic landscape, and any other elements which may contribute to the historical and cultural heritage of the area.

1.2 Site Location

- 1.2.1 The Site starts at NGR 448636 191412 and ends at NGR 454826 19631 (Figure 1). The Site begins at Milton Interchange, c. 780 m south of Milton, and follows the A4130 east, bordered by the Great Western Railway to the north, and fields to the south. After c. 1.80 km the Site crosses the A4130 and railway line and through the former Didcot A Power Station development site. From here the Site joins the A4130 Northern Perimeter Road and then runs north following an existing haulage road to just west of the Appleford level crossing. From this point the Site continues northwest, across an area of quarry, the Appleford railway sidings, and further quarries filled with landfill. The Site then meets Appleford Road, 580 m west of Appleford, and then crosses through extensively quarried areas to the River Thames. After crossing the river, the Site continues c.850 m through fields to meet the A415 (Abingdon Road), and runs east along the A415, to c. 550 m east of Culham Railway Station. The Site then continues northeast, skirting the southeast limits of Culham Science Park, following the existing Thame Lane. At NGR 454243 195886 the Site deviates from Thame Lane and crosses northeast, through fields, until it meets the B4015, c. 630 m north of Clifton Hampden.

1.3 Scheme Description

- 1.3.1 OCC's proposed package of strategic transport improvements are vital elements of Didcot's development as a "Garden Town". The package includes four interdependent schemes:
- A4130 – The proposed improvement to the A4130 include dualling, between Milton Interchange at the A34 and the proposed new Science Bridge. The proposal also includes the provision of new and improved pedestrian and cycling facilities;
 - Didcot Science Bridge – A new road link from the new dualled section of the A4130, over the railway back to the A4130 north of Purchas Road, including pedestrian and cycling infrastructure;
 - Didcot to Culham River Crossing – a new road between Culham near the Science Centre to Didcot's A4130 perimeter road, including pedestrian and cycling infrastructure; and
 - Clifton Hampden Bypass – a new road between the A415, Abingdon Road, at the Culham Science Centre and B4015, Oxford Road, north of Clifton Hampden village.

1.4 Aims

1.4.1 The aims of the assessment are:

- to identify designated heritage assets within the Site and study area and assess components of their setting that contribute to their significance;
- to place the Site within its full historic/archaeological context through the collection of baseline information;
- to identify known non-designated heritage assets within the Site;
- to identify the potential for previously unrecorded heritage assets within the Site.

1.5 Structure of Document

1.5.1 This report is divided into the following sections:

- Section 2: Legislation and Planning Policy which provides an overview of the planning policy framework and Historic England's policy and guidance.
- Section 3: Assessment Methodology which describes the proposed methods for the assessment and how the study area was determined.
- Section 4: Baseline Conditions describes the archaeological and historic background of the Site and study area, and description of assets. This section also includes an assessment of archaeological potential.
- Section 5: Assessment of Baseline presents a review of the baseline for the study area considering both designated and non-designated heritage assets and their settings to identify where they have the potential to be affected by the Scheme. It provides an assessment of the archaeological potential within the Site and the sensitivity of the historic landscape character to change.
- Section 6 Conclusion summarises the findings of the baseline assessment and those assets that are scoped out and scoped in to the Cultural Heritage Chapter of the Environmental Statement (ES).

2. Legislation and Planning Policy Context

2.1 Legislative Background

The Ancient Monuments and Archaeological Areas Act 1979

- 2.1.1 The Ancient Monuments and Archaeological Areas Act imposes a requirement for Scheduled Monument Consent for any works of demolition, repair, and alteration that might affect a designated Scheduled Monument (SM).

The Planning (Listed Buildings and Conservation Areas) Act 1990

- 2.1.2 The Planning (Listed Buildings and Conservation Areas) Act 1990 (the Act) sets out the principal statutory provisions that must be considered in the determination of any application affecting listed buildings and conservation areas.
- 2.1.3 Section 66 of the Act states that in considering whether to grant planning permission for development which affects a listed building or its setting, the local planning authority or, as the case may be, the Secretary of State shall have special regard to the desirability of preserving the building or its setting or any features of special architectural or historic interest which it possesses. By virtue of Section 1(5) of the Act a listed building includes any object or structure within its curtilage.
- 2.1.4 Section 72 of the Act establishes a general duty on a local planning authority or the Secretary of State with respect to any buildings or other land in a Conservation Area to pay special attention to the desirability of preserving or enhancing the character or appearance of a Conservation Area.

2.2 Planning Policy

National Planning Policy Framework (NPPF)

- 2.2.1 The NPPF (Ministry of Housing, Communities and Local Government (MHCLG), 2021) sets out the Government's planning policies for England and how these should be applied to contribute to the achievement of sustainable development. While the EIA methodology forms part of a separate planning regime, the planning decision still takes account of national guidance. As such, it is important to understand where the development fits within this.
- 2.2.2 Section 16 of the NPPF deals specifically with the historic environment. Where changes are proposed, the NPPF sets out a clear framework to ensure that heritage assets are conserved, and where appropriate enhanced, in a manner that is consistent with their significance.
- 2.2.3 The NPPF sets out the importance of being able to assess the significance of heritage assets that may be affected by a development. Significance is defined in Annex 2 as being the, "*value of a heritage asset to this and future generations because of its heritage interest. That interest may be archaeological, architectural, artistic or historic*". Significance is not only derived from an asset's physical presence, but also from its setting. The setting of a heritage asset is defined in Annex 2 as, "*the surroundings in which a heritage asset is experienced. Its extent is not fixed and may change as the asset and its surroundings evolve*".
- 2.2.4 Paragraph 194 of the NPPF states that in determining applications, local planning authorities should require an applicant to describe the significance of any heritage assets affected, including any contribution made by their setting. The level of detail should be proportionate to the assets' importance and no more than is sufficient to understand the potential impact of the proposal on their significance. Similarly, there is a requirement on local planning authorities, having assessed the particular significance of any heritage asset that may be affected by a

proposal; to take this into account when considering the impact of a proposal on a heritage asset (paragraph 195).

2.2.5 In determining planning applications, local planning authorities should take account of the following points:

- the desirability of sustaining and enhancing the significance of heritage assets and putting them to viable uses consistent with their conservation;
- the positive contribution that conservation of heritage assets can make to sustainable communities including their economic vitality;
- the desirability of new development making a positive contribution to local character and distinctiveness (paragraph 197); and
- opportunities to draw on the contribution made by the historic environment to the character of a place.

2.2.6 Paragraphs 199 to 203 of the NPPF introduce the concept that heritage assets can be harmed or lost through alteration, destruction or development within their setting. This harm ranges from less than substantial through to substantial. With regard to designated assets, paragraph 193 states that great weight should be placed on its conservation, irrespective of whether any potential harm is considered to be substantial or less than substantial. The paragraph goes further to say that the more important the asset, the greater the weight should be on its conservation. In paragraph 200, a distinction is made in respect of those assets of the highest significance (e.g. Scheduled Monuments, Grade I and grade II* listed buildings) where substantial harm to or loss should be wholly exceptional.

2.2.7 In instances where development would cause substantial harm to or total loss of significance of a designated asset consent should be refused unless it can be demonstrated that it is necessary to achieve substantial public benefits that outweigh that harm or loss (paragraph 201). In instances where development would cause less than substantial harm to the significance of a designated asset the harm should be weighed against the public benefits of the proposal to provide a balanced judgement (paragraph 202).

2.2.8 With regard to non-designated assets, paragraph 203 states that the effect of the application on the significance of the asset should be taken into account in determining the application. A balanced judgement will be required having regard to the scale of any harm or loss and the significance of the heritage asset.

Planning Practice Guidance (PPG)

2.2.9 The PPG (MHCLG 2019) is a government produced interactive on-line document that provides further advice and guidance to accompany policies in the NPPF. It expands on terms such as 'significance' and its importance in decision making. In particular, paragraph 008 states that *'understanding the significance of a heritage asset and its setting from an early stage in the design process can help to inform the development of proposals which avoid or minimise harm. Analysis of relevant information can generate a clear understanding of the affected asset, the heritage interests represented in it, and their relative importance'* (Paragraph 008, Ref. ID: 18a-008-20190723, Revision date: 23 07 2019).

2.2.10 The PPG clarifies that being able to properly assess the nature, extent and the importance of the significance of the heritage asset and the contribution of its setting, is very important to understanding the potential impact and acceptability of development proposals. This information should be proportionate to the asset's importance and no more than is sufficient to understand the potential impact of the proposal on its significance (Paragraph: 009, Ref. ID: 18a-009-20140306, Revision date: 23 07 2019). Setting is also discussed in paragraph 013 which stresses that setting is not only visual but can be influenced by historic or aesthetic considerations (Paragraph 013, Ref. ID: 18a-013-20190723, Revision date: 23 07 2019).

2.2.11 When considering impacts to a heritage asset, the PPG usefully discusses how to assess whether harm is caused. Paragraph 018 identified that a proposed development may have no impact on its significance or may enhance its significance and therefore cause no harm. Where potential harm to designated heritage assets is identified, it needs to be categorised

as either less than substantial harm or substantial harm. The guidance goes on to state that *‘within each category of harm (which category applies should be explicitly identified), the extent of the harm may vary and should be clearly articulated’* (Paragraph: 018 Ref. ID: 18a-018-20190723, Revision date: 23 07 2019).

- 2.2.12 The NPPF indicates that the degree of harm should be considered alongside any public benefits that can be delivered by development. The PPG states that these benefits should follow from the proposed development and should be of a nature and scale to be of benefit to the public and not just a private benefit. However, benefits do not always have to be visible or accessible to the public in order to be of public benefit. Public benefits may include heritage benefits, such as:

- sustaining or enhancing the significance of a heritage asset and the contribution of its setting;
 - reducing or removing risks to a heritage asset; and,
 - securing the optimum viable use of a heritage asset in support of its long-term conservation.
- (Paragraph: 020 Ref. ID: 18a-020-20190723, Revision date: 23 07 2019).

2.3 Local Planning Policy

- 2.3.1 The Scheme passes through the Vale of White Horse district and South Oxfordshire district, both of which have policies that relate to heritage. These are summarised below:

Vale of White Horse District Council (VoWHDC)

- 2.3.2 Part 1 of the VoWHDC Local Plan (Vale of White Horse Local Plan, 2016a) sets out the Council's core policy with regards to the Historic Environment, including the policy that *‘the Council will work with landowners, developers, the community, Historic England and other stakeholders to:*

- ensure that new development conserves, and where possible enhances, designated heritage assets and non-designated heritage assets and their setting in accordance with national guidance and legislation (Vale of White Horse Local Plan, 2016a, Core Policy 39)”

- 2.3.3 Part 2 of the Local Plan 2031 (Detailed Policies and Additional Sites) was adopted on the 9th October 2019. Development policies within the Local plan relating to heritage include policy 36 (Heritage Assets), policy 37 (Conservation Areas), policy 38 (Listed Buildings), and policy 39 (Archaeology and Scheduled Monuments). Policy 36 states *‘proposals for new development that may affect heritage assets (designated and non-designated) must demonstrate that they conserve and enhance the special interest or significance of the heritage asset and its setting in accordance with Core Policy 39 (Local Plan 2031: Part 1), and particularly where they:*

- i. make a positive contribution to local character and distinctiveness and/or
- ii. make a positive contribution towards wider social and economic benefits and / or
- iii. provide a viable future use for a heritage asset that is consistent with the conservation of its significance, and / or
- iv. provide a sustainable, non-damaging use for a heritage asset that is currently at risk of neglect, decay or other threats’ (Development Policy 36, Vale of White Horse Local Plan, 2019)”.

- 2.3.4 The Local Plan also states that *‘when considering the impact of a proposed development on the significance of a designated heritage asset, great weight will be given to the asset’s conservation (and the more important the asset, the greater the weight that will be given). This is irrespective of whether any potential harm amounts to substantial harm, total loss or less than substantial harms to its significance’*. With regards to designated heritage assets the policy states that a *‘clear and convincing justification’* is required (Development Policy 36, Vale of White Horse Local Plan, 2019).

- 2.3.5 The policy also states that the developers *‘will also be expected to report, publish and deposit the results of any investigations into heritage assets with the Historic Environment Record*

(HER) and the relevant local and county authorities' (Development Policy 36, Vale of White Horse Local Plan, 2019).

South Oxfordshire District Council (SODC)

- 2.3.6 South Oxfordshire Local Plan 2011 - 2035 was adopted in December 2020.
- 2.3.7 Policies within the Local Plan (South Oxfordshire Local Plan, 2035) pertaining to heritage include policy ENV6 (Historic Environment), policy ENV7 (Listed Buildings), ENV8 (Conservation Areas), ENV9 (Archaeology and Scheduled Monuments) and ENV10 Historic Battlefields, Registered Parks and Gardens and Historic Landscapes.

Burcot and Clifton Hampden Neighbourhood Plan 2011-2034 - Pre-submission Draft (Nov 2020)

- 2.3.8 The Burcot and Clifton Hampden Neighbourhood Plan project was launched in 2017 and at the time of writing was going through pre-submission consultation with the local community. The formal submission to SODC is due to take place in May 2021. The Neighbourhood Plan, once 'made', will provide a comprehensive picture of how the vision for the parish to 2034 and beyond will be realised. The pre-submission draft Neighbourhood Plan document (Nov 2020) make allowance for the land required for a Clifton Hampden Bypass which will be delivered as part of the Scheme. It also contains the following policies of relevance of this assessment, and these can be viewed as emerging local policy;
- 2.3.9 Policy BCH6, 'Design Principles in Clifton Hampden', states that '*proposals for development will be supported, provided they sustain and enhance the distinctiveness of the village and, where appropriate, the character and appearance of the Clifton Hampden Conservation Area and its setting.*' The explanatory text identifies seven distinct character areas within the conservation area: Upper High Street, Lower High Street, A415 East, A415 West, Courtiers Green, Oxford Road and Watery Lane. The areas reflect the different periods of growth of the village since medieval times.
- 2.3.10 Policy BCH9, 'Local Landscape Character', states that '*the culturally and historically important local landscape character of the parish, and in particular the waterscape of the River Thames corridor and its setting, will be conserved and where possible enhanced. Large-scale development of any kind will be inappropriate within open countryside and the river corridor.*' The explanatory text notes the significance of archaeological assets in the landscape around the settlement, as well as noting that the floodplain pasture and landscape around the villages are an important component of the setting of Clifton Hampden conservation area and other designated heritage assets.

2.4 Other Guidance

Historic England Guidance

- 2.4.1 Historic England (HE) published a series of Good Practice Advice (GPA) notes of which those of most relevance to this assessment are GPA2 - Managing Significance in Decision-taking (HE 2015c), GPA3 - The Setting of Heritage Assets (Second Edition) (HE 2017d) and Advice Note 12 – Statements of Heritage Significance (2019).
- 2.4.2 GPA2 emphasises the importance of having a knowledge and understanding of the significance of heritage assets likely to be affected by the development and that the "*first step for all applicants is to understand the significance of any affected heritage asset and, if relevant the contribution of its setting to its significance*" (paragraph 4). Early knowledge of this information is also useful to a local planning authority in pre-application engagement with an applicant and ultimately in decision making (paragraph 7).
- 2.4.3 GPA3 provides advice on the setting of heritage assets. Setting is as defined in the NPPF and comprises the surroundings in which a heritage asset is experienced. Elements of a setting can make positive or negative contributions to the significance of an asset and affect the ways

in which it is experienced. Historic England states that setting does not have a boundary and what comprises an asset's setting may change as the asset and its surrounding evolve. Setting can be extensive and particularly in urban areas or extensive landscapes can overlap with other assets. The contribution of setting to the significance of an asset is often expressed by reference to views and the GPA in paragraph 11 identifies those views such as those that were designed or those that were intended, that contribute to understanding the significance of assets.

- 2.4.4 Advice Note 12 outlines a recommended approach to assessing the significance of heritage assets in line with the requirements of NPPF. It includes a suggested reporting structure for a 'Statement of Heritage Significance', as well as guidance on creating a statement that is proportionate to the asset's significance and the potential degree of impact of a proposed development. The Advice Note also offers an interpretation of the various forms of heritage interest that an asset can possess, based on the terms provided in the NPPF Glossary (Annex 2: Glossary); namely archaeological, architectural and artistic, and historic.

Chartered Institute of Archaeologists

- 2.4.5 The CHDBA was prepared by a competent expert in the discipline of archaeology and in accordance with guidance published by the Chartered Institute for Archaeologists (CIfA), specifically the standard and guidance for historic environment desk-based assessment (CIfA, 2020); and in consultation with and advice from Historic England and OCC Planning Archaeologist.

3. Assessment Methodology

- 3.1.1 This assessment has been undertaken in line with the standard and guidance for historic environment desk-based assessment (ClfA, 2020); and OCC comprehensive advisory document (OCCAS 2019). In compliance with the OCCAS a WSI was prepared prior to the preparation of the CHDBA, outlining the methodology and sources to be consulted for the preparation of the CHDBA.

3.2 Sources of Information/Data

- 3.2.1 The following sources of information have been reviewed and form the basis of the assessment of likely significant effects on the Historic Environment in the ES:

- Oxfordshire County Historic Environment Record (HER);
- the National Heritage List for England (NHLE) held by Historic England;
- Designated assets such as Scheduled Monuments, Conservation Areas and Listed Buildings;
- Ordnance Survey maps (19th and 20th century) at 1:10000, 1:10560, 1:2500 and 1:1250 scales;
- tithe maps (and apportionments), estate maps and any other relevant historical maps within the relevant County Record Office (parts of Oxfordshire were formerly part of Berkshire and may still be covered by the Berkshire Record Office), or readily available elsewhere;
- English Place Name Society volumes or similar authoritative works covering place names of the study area;
- Geological maps of the study area;
- Geotechnical reports where such evidence is not being separately assessed;
- Previous archaeological evaluation and excavation records relating to sites in and immediately adjacent to the study area;
- Other published works, reports and information relevant to the desk-based assessment;
- Air photographic collections by Historic England Swindon and such other collections as are held by OCC within the HER for the area of study (beyond the specific development area);
- An assessment of any Lidar (Figure 20) data held by the Environment Agency (EA) for the study area (beyond the specific development area).
- The Oxfordshire Historic Landscape Characterisation data (provided as part of the HER consultation);
- National Mapping Programme Data where available;
- Portable Antiquities Scheme (PAS) data, available from the PAS website' (OCAS 2019); and
- Regional research frameworks.

- 3.2.2 The designated and non-designated heritage assets within this assessment are identified with a unique identifier (eg [A1]). Assets referred to that are outside the formal study area will be referenced using their National Heritage List for England numbers (eg [NHLE: 1354687]). All assets are identified within the text and can be cross-referenced to the gazetteer in Appendix 7.1 (where their HER or NHLE number, type, and short description are also listed). The assets are shown on Figures 2 and 3.

3.3 Extent of Study Area

- 3.3.1 The Design Manual for Roads and Bridges (DMRB) defines a study area “according to the sensitivity of the receiving environment and the potential impacts of the project”. The guidance continues:

“Where a new road is proposed the study area shall include the footprint of the scheme plus any land outside that footprint which includes any heritage assets which could be physically affected.

The study area should include the settings of any designated or other cultural heritage resource in the footprint of the scheme or within the zone of visual influence or potentially affected by noise.

The study area used in the assessment shall be agreed with the Overseeing Organisation” (Highways England 2019, DMRB, Volume 11, Part 2, LA 106, 3.5 – 3.7).

- 3.3.2 Following consultation with the Oxfordshire County Council Archaeological Services (OCCAS), the study area herein comprises the footprint of the Scheme and extends to 1km surrounding the scheme for designated and non-designated cultural heritage resources, in order to assess the potential effects of the Scheme on the physical fabric and their setting.

3.4 Site Visit

- 3.4.1 A site visit and visual appraisal of heritage assets within the proposed redline boundary were undertaken by an archaeological specialist and a built heritage specialist on the 19th March 2020. The purpose of the site visit was to:

- Identify known archaeological sites within the site;
- Identify historic buildings and related assets including listed buildings, conservation areas and locally listed buildings within the application site and its surrounding study area;
- Identify areas with the potential to contain any previously unidentified archaeological or historical remains;
- Identify and assess the setting of heritage assets within the study area; and
- Identify the location, extent and severity of modern ground disturbance and previous construction impacts.

3.5 Consultation

- 3.5.1 An EIA Scoping Report for the Scheme was prepared and submitted to OCC on 30th April 2020, seeking an opinion on the content and extent of information that should be included in the EIA and reported in the ES. The complete Scoping Opinion was received on 2nd July 2020. A summary of consultation responses and actions taken is provided in Chapter 7, Table 7.1.
- 3.5.2 An initial consultation with the OCC Archaeologist was conducted on the 15th November 2019. The OCC Archaeologist requested that the EIA use a study area of 1km (buffer zone) for designated and non-designated cultural heritage resources.
- 3.5.3 A meeting took place on the 5th March 2020 with OCC Archaeologists, Historic England, and the Client. During this consultation a thorough overview and high-level program review was provided followed by a discussion on locations within the scheme and its footprint that were of less concern and those of most concern in terms of likelihood of archaeological remains surviving and therefore likely impacts.
- 3.5.4 Consultation with the OCC Archaeologist has continued throughout the EIA period, with regards to scope and method of archaeological evaluation and assessment.

3.6 Significance of Heritage Assets

- 3.6.1 The significance of identified heritage assets has been determined by professional judgement guided by statutory and non-statutory designations, national, regional and local policies, archaeological research frameworks and the modified criteria for Scheduled Monuments used in England by the Secretary of State for (Digital,) Culture, Media and Sport (DCMS, 2013). An assessment of the significance of assets and their setting has been undertaken in consideration of guidance and good practice issued by Historic England. A methodology for the assessment of significance of heritage assets is outlined in Advice Note 12 (Historic England, 2019).
- 3.6.2 The NPPF (Annex 2: Glossary) defines significance as ‘the value of a heritage asset to this and future generations because of its heritage interest. That interest may be archaeological, architectural, artistic or historic. Significance derives not only from a heritage asset’s physical presence, but also from its setting’.
- 3.6.3 Significance is often established by statutory designations such as listed buildings, scheduled monuments and conservation areas. More particular advice as to what makes up significance is set out in Advice Note 12, which establishes a method for thinking consistently about the heritage values that can be ascribed to a place. When assessing the significance of an asset numerous considerations include architectural interest, historic interest, group value, social value, former uses and local distinctiveness.
- 3.6.4 The terminology used in this assessment relates to the terminology used by NPPF and the Advice Note 12, referring to significance in terms of heritage interest and not heritage values and the methodology for assessing the heritage interest follows Advice Note 12. While heritage interest and heritage values are not completely interchangeable, they are broadly similar.
- 3.6.5 The significance of potential heritage assets is based on regional research resource assessments and research frameworks to assess the potential that the site has to address research questions as set out in the Solent-Thames Research Framework (Hey and Hind 2014), as well as thematic and period-specific reviews such as the prehistoric period (HE 2010), the Palaeolithic and Mesolithic periods (Pettitt, Gamble & Last (eds) 2008; Prehistoric Society 1999), the Bronze Age (Roberts 2008), the Iron Age (Haselgrove et al. 2001) the Roman period (James and Millett (eds) 2001; EH 2012; Van der Veen et al. 2007), environmental archaeology and wetland heritage (EH 2011; EH 2012; EH 2012) and Historic England’s Introductions to Heritage Assets and Selection Guides.

3.7 Archaeological Potential

- 3.7.1 The potential for an area to contain archaeological remains is rated ‘high’, ‘medium’, ‘low’, ‘negligible’, or ‘unknown’. This rating is based on an understanding of the archaeological resource as a whole and its national, regional and local context. This includes the number, proximity and significance of known and predicted archaeological/historical sites or find spots within the site and its surrounding study area.

3.8 Previous Ground Disturbance

- 3.8.1 The previous impact to buried archaeological remains caused by historic development has been assessed using a five-point scale of ‘very high’, ‘high’, ‘medium’, ‘low’ and ‘very low’, the definitions of which are set out in below.

Table 3-1 Level of previous ground disturbance

Magnitude of previous disturbance	Description
Very High	Deep level basement/sub-basement excavated into the underlying natural geology resulting in the removal of all subsurface archaeological deposits.

High	Extensive and deep disturbance resulting in the removal of all but the deepest archaeological deposits such as wells or quarry pits, deep foundations, quarrying and large utilities.
Medium	Moderate previous disturbance which may extend to some depth, but where there remains the potential for archaeological remains to survive either between or beneath existing impact levels such as building foundations and utility trenches.
Low	Shallow previous disturbance such as areas of car parking and surfacing where archaeological remains may survive with limited truncation beneath the level of impact.
Very Low	No known historic development impacts to subsurface archaeological remains. Potential for the survival of archaeological horizons from Prehistory to the Post-medieval period.

3.9 Limitations and Assumptions

- 3.9.1 The report is predominantly based on secondary sources of data that were available at the time of writing.
- 3.9.2 This baseline report is based on desk based research and the results of geophysical survey. At the time of writing trial trench evaluation of the Site is currently being carried out and reported on.

4. Baseline Conditions

4.1 Designated Heritage Assets

- 4.1.1 There are no designated assets within the Site. Impacts to designated assets are therefore assessed only in terms of impacts caused through change to their settings and how this affects their significance.
- 4.1.2 Within the study area, there are five Scheduled Monuments, one registered park and garden, six conservation areas and 92 listed buildings.
- 4.1.3 There are no World Heritage Sites, Registered Battlefields or Protected Wrecks within the study area.
- 4.1.4 Cropmark evidence provided by the Historic England Archive is plotted on Figure 20.

Scheduled Monuments

- 4.1.5 The Scheduled Monuments within the study area comprise four settlement sites and one round barrow cemetery. The first settlement site SM 1004853 **[A25, A26, A28]** contains a ladder enclosure, possibly dating to the Iron Age, and a zone of multiperiod occupation from the Iron Age to Early Medieval period (Cotswold Archaeological Trust, 2000). The second settlement site SM 1004849 **[A76]** covers an area of dense cropmarks including ring ditches, rectangular enclosures and parallel ditches, representing an Iron Age to Early Medieval settlement. The third settlement site SM 1006345 **[A117]** contains around twelve overlapping rectangular enclosures and ditches with scattered pits. The fourth settlement site is at Northfield Farm SM 1002925 **[A219]** and comprises an Iron Age and Roman settlement, as well as burials dating from the Bronze Age through to the 3rd century AD. The final Scheduled Monument is the round barrow cemetery at Fullamoor Plantation SM 1421606 **[A109]** which contains several Bronze Age ring ditches and other features and is classed as a barrow cemetery.

Registered Park and Garden

- 4.1.6 Part of one registered park and garden lies within the in the study area; namely the Grade I Registered Nuneham Courtenay **[A207]**. It comprises an 18th century landscaped park and pleasure ground associated with Nuneham House and including Nuneham Courtenay Arboretum.

Conservation Areas

- 4.1.7 There are six conservation areas in the study area; at Milton, Sutton Courtney, Culham, Didcot (Old) Town, Clifton Hampden and Nuneham Courtney. These conservation areas represent several of the main settlement foci in the study area and each contain several listed buildings.

Listed Buildings

- 4.1.8 There are 92 listed buildings within the study area, including one listed at Grade I and six listed at Grade II*. Listed Buildings within the study area are generally clustered in the area's settlement foci, such as at Milton, Sutton Courtenay, Didcot, Appleford, Culham and Clifton Hampden, and within parkland at Nuneham Courtenay. Apart from Appleford, these areas are all designated as conservation areas, and Nuneham Courtenay has an additional designation as a Registered Park and Garden which covers a larger extent than the conservation area. There are a small number of assets located outside these areas, generally these are associated with the Great Western Railway, such as the Grade II listed Railway Transfer Shed and Engine Shed **[A65 and A66]**, to the south of Didcot railway station, and the Grade II* listed Culham Station, Ticket Office and Waiting Room **[A209]** and its associated Grade II listed Overbridge and Thame Lane Bridge **[A160; A212]**, east of Culham. Further isolated listed buildings are the Grade II listed Fullamoor Farmhouse **[A161]** and the Grade II listed Schola Europea **[A155]**, the former Diocesan training college north-east of Culham.

- 4.1.9 Apart from the Grade II* listed Culham Station, Ticket Office and Waiting Room [A209], the Grade I and II* listed buildings within the study area are located in the area's settlements of Milton, Didcot and Clifton Hampden. Milton contains the Grade I listed Milton Manor Cottage and Milton Manor House [A3], the Grade II* listed Church of St Blaise [A4] and 42a and 42b High Street [A8]. Didcot contains the grade II* listed Church of All Saints [A235]. Clifton Hampden contains the Grade II* listed Clifton Hampden Bridge [A178] and Church of St Michael and All Angels, High Street [A185].

4.2 Assets within the Site

- 4.2.1 There are 11 recorded non-designated heritage assets within the Site. Of these, some are no longer extant (due to excavation and/or quarrying) and some are partially extant. These include the following:

- **Mesolithic to Roman remains south of A4130 [A54], [A60].** The Scheme runs through fields previously investigated as part of the Valley Park and Didcot West developments. These works indicated continuous occupation of the area between the Mesolithic and Medieval periods. The Scheme crosses an area where a series of ditches and field systems were recorded.
- **Undated ditches, pit, rectangular enclosure and trackway [A36].** The Scheme runs through features identified through cropmarks and geophysical survey, near to Hill Farm.
- **Undated linear feature, rectilinear enclosure, and pit [A70].** The Scheme runs through features identified through cropmarks. Asset is no longer extant within the Site.
- **Undated linear feature, rectilinear enclosure, and trackway [A71].** The Scheme runs through features identified through cropmarks. Asset is no longer extant within the Site.
- **Bronze Age Beaker Burial [A93].** The Scheme runs through the site of a vessel found with an inhumation in c.1862. Asset is no longer extant
- **Late Bronze Age to Early medieval remains at Appleford Settlement [A101].** The Scheme passes through a 20ha area, which showed evidence of occupation from Iron Age to Romano British periods. Excavations of the complex occurred in 1969 and in 1973. These revealed Late Bronze Age pits, a sequence of mid Iron Age enclosures, trackway, possible field boundaries, Roman ditched trackway, enclosure system, waterholes and small Early Medieval or Late Roman inhumation cemetery (Hinchliffe, J. and Thomas, R. 1980). Prior to excavation, several Roman hoards were retrieved from within this area, including 24 pieces of pewter, including large dishes and jug, iron chains, lock and chisels; 6-12 Iron Age currency bars; and a Roman coin hoard consisting of 5,650 coins, buried in two vessels. Individual assets recorded within the overall site include A97-101 and 103). The settlement has been largely excavated. This archaeological excavation has extended across the Site on the southern side of the River Thames, removing archaeological remains within this area.
- **Neolithic to Roman funerary and agricultural remains and possible Roman villa at Bridge Farm (Penn Copse) [A108].** The Scheme runs through an area where, prior to quarrying, cropmarks of rectangular enclosures and parallel lines were recorded in 1961, which were interpreted as a possible Roman villa. Limited excavation in 1962/62 revealed buildings, stone-lined well or storage pits and Roman material. The copse was bulldozed, and this was found to have destroyed much of the site. Excavations at 'Bridge Farm' have revealed a middle Bronze Age cremation, a ring ditch and further Bronze Age ditches, Iron Age and Roman field systems and Iron L-shaped enclosure (Oxford Archaeology 2017).
- **Possible undated enclosure [A142].** Possible undated enclosure visible as cropmark.
- **Series of undated features which may represent enclosures and pits at Fullamoor Farm [A163].** The Scheme crosses fields where cropmarks have been recorded spanning an area 340m by 425m. Here, a series of lines are clearly recognizable and appear to be analogous to those which appear yearly at Northfield Farm, Long Wittenham. As such, these are likely to represent Late Prehistoric and Roman field systems or settlement.
- **Early medieval cemetery [A193].** The Scheme runs through an area where an early medieval inhumation may have been recovered.

4.3 Physical Site Conditions

Scheme Topography

- 4.3.1 The Scheme crosses a wide and varied landscape that encompasses agricultural fields, former industrial lands, quarries, landfill, the River Thames and its floodplain. The Site skirts around the outskirts of a number of towns and villages, including Milton, Didcot, Appleford, and Clifton Hampden.
- 4.3.2 From south to north, the Scheme begins at Milton Interchange, c. 780m south of Milton, and follows the A4130 east, with the railway tracks of the Great Western Railway to the north, and fields to the south. The ground level is relatively flat, at c. 60m AOD, rising upward southwest of the Site, at Milton Heights, at C. 100m AOD.
- 4.3.3 After c. 1.80km the Site crosses the A4130 and railway line and through the former Didcot A Power Station site to join the A4130 Northern Perimeter Road that bounds Didcot. Here the ground level is c.55m AOD; and comprises agricultural fields with field drains, lying in between the A4130, the former power station, and quarries to the north.
- 4.3.4 From the A4130, the Scheme continues north, following an existing haulage road. North of Hill Farm and continuing to the River Thames, the land has been extensively quarried, with areas of mounded landfill and landscaped spoil as well as areas of water filled quarry pits. To the north of Appleford Crossing the Site continues northwest, across an area of quarry, the Appleford railway sidings, and further quarries filled with landfill. The Scheme then meets Appleford Road, 580m west of Appleford, and then crosses through extensively quarried areas to the River Thames.
- 4.3.5 The northern bank of the River Thames is at c.45m AOD, rising to 55m AOD, c.100m north of the river. From here, the Scheme continues c.850m through fields to meet the A415 (Abingdon Road), at c. 60m AOD. The Scheme then runs east along the A415, to c. 550m east of Culham Railway Station. The Site then continues northeast, skirting the southeast limits of Culham Science Park, following the existing Thame Lane. At NGR 454243 195886 the Site deviates from Thame Lane and crosses northeast, through fields, until it meets the B4015, c. 630m north of Clifton Hampden.

Scheme Geology

- 4.3.6 The geological sequence varies along the route of the Scheme. The sedimentary bedrock north of the River Thames, with mudstone bedrock of the Gault Formation to the south and sandstone bedrock of the Lower Greensand Group Sheet (British Geological Survey Viewer). According to the British Geological Survey viewer, accessed 8th April 2020, the overlying superficial geology is described below:
- A4130 Widening: The geology of this section of the Scheme is mudstone bedrock of the Gault Formation overlain by Head deposits comprising clay, silt, sand.
 - Science Bridge: The superficial deposits within this comprise Head deposits to the south, passing through alluvium (indicating an east-west body of water), and Wolvercote Sand and Gravel, which are also fluvial in origin.
 - Didcot to Culham River Crossing: Wolvercote Sand and Gravel and Northmoor Sand and Gravel are located just south of Appleford level crossing (except where these gravels have been quarried). The Scheme then passes through alluvium either side of the River Thames. Underlying the Scheme, north of the river and prior to Abingdon Road, are sandstone bedrock of the Lower Greensand Group and mudstone of the Gault Formation. Overlying these are Northmoor Sand and Gravel to the south and Summertown-radley Sand and Gravel to the north.
 - Clifton Hampden Bypass: This section of the Scheme comprises sandstone bedrock of the Lower Greensand Group, with occasional locations of Wolvercote Sand and Gravel and Summertown-radley Sand and Gravel.

Walkover Survey

- 4.3.7 A walkover survey was conducted on the 19th March 2020 along the route of the Scheme. The survey avoided arable fields and used Public Rights of Ways where available. The walkover did not include the former Didcot A Power Station site due to access restrictions owing to coronavirus, nor did it include the fields south of the A4310 (Valley Park).
- 4.3.8 During the walkover no additional cultural heritage resources were noted.
- 4.3.9 Assets in the surrounding area were also visited to assess their significance and the degree to which their settings contribute to that significance. This focused on refining the list of assets within the study area where there is potential for impacts as a result of the Scheme.
- 4.3.10 The walkover was conducted from northeast to south, beginning in the field adjacent to the B4015 (Oxford Road). The Scheme crosses four arable fields before reaching the boundary of Culham Science Park. From these fields the outer, non-designated wooded limits (New Covert) of Nuneham Park and Gardens are visible (Plate1).



Plate 1 The field adjacent to the B4015, with the location of the proposed roundabout in the foreground. The woods visible in the background are the outer, non-designated wooded limits of the registered Nuneham Park and Gardens (northwest facing)

- 4.3.11 The division between the first and second fields is a ditch (filled with water) and tree boundary (Plate 2); the division between the second and third fields is a ditch filled with water; and the division between field 3 and 4 is a substantial tree boundary and Thame Lane, which encircles field 4 completely, a route that was used to access the airfield camps to the north.



Plate 2 On the location of the proposed roundabout in the first field, looking southwest along the length of the proposed Scheme, with fields 2 and 3 beyond the first tree boundary

- 4.3.12 At the southern border of field 4, Thame Lane heads north and west (Plate 3), which are the portions of the 'lane' which encircled the runways of RNAS Culham airfield. The Scheme utilises the northeast-southwest stretch of Thame Lane. The eastern portion of this was inaccessible, with a mounded area, covered in brambles (Plate 4). According to plans of the RNAS Culham airfield, this area had been occupied by hangers and aircraft standings, and it is possible the mounded area represents debris from these demolished structures (Plate 5). Beyond this, Thame Lane is accessible, with the fence bordering Culham Science Park to the northwest and with fields (non-arable) to the southeast (Plate 6).
- 4.3.13 The southwestern end of Thame Lane connects with the Science Park Junction, and from here the Scheme crosses a landscaped area, with footpath and a number of trees (Plate 7). Beyond this plot, the Scheme crosses a fenced off plot of land, an area where cropmarks suggest the presence of archaeological remains (Plate 8). The southern and western limits of this area are banked to accommodate roads, with the southern bank enabling Abingdon Road to cross the railway line (Plate 9). To the west of this and within the proposed redline boundary, Abingdon Road becomes more steeply banked (Plate 10).



Plate 3 Thame Lane at the western limits of Field 3, which continues around Culham Science Park (north facing).



Plate 4 The mounded area covering the eastern portion of Thame Lane (west facing).



Plate 5 Part of the mounded area banked up over the eastern portion of Thame Lane. The concrete beneath the foliage may represent some elements of the demolished airbase (north facing).



Plate 6 Thame Lane, with the fence of Culham Science Park (right) and non-arable field (left) (southwest facing).



Plate 7 View and direction of the proposed scheme crossing a landscaped area next to Culham Science Park junction (southwest facing).



Plate 8 The fenced off plot of land, wherein cropmarks suggest the presence of archaeological remains. It is within this area that a roundabout is proposed (northeast facing).



Plate 9 The raised bank of Abingdon Road (right), prior to its crossing of the railway line, with the cropmarked plot of land (left) (east facing).



Plate 10 The steep bank of Abingdon Road, prior to crossing the railway line (south facing).

- 4.3.14 West of this, the Scheme joins Abingdon Road and its associated footpath, to just east of the Grade II listed Schola Europaea **[A155 1194452]**. Here, a roundabout is proposed (Plate 11), which will link with Abingdon Road and the portion of the Scheme that crosses the River Thames. From here, the Scheme crosses through c.700m of arable field, wherein ceramic building material and burnt flint were noted within the ploughsoil. Midway through the field, ridges are noticeable, that slope down to the River Thames (Plate 12).
- 4.3.15 At the southern end of the field, the Scheme is visible from the scheduled monument **A117 SM1006345** (Plate 13). Although, due to the tree lined field boundary to the north of the SM, only a portion of the Scheme is likely to be visible, not the full extent, up to Abingdon Road (Plate 14). From the SM, although Abingdon Road and the train track are barely visible, there is considerable noise from both.

- 4.3.16 Beyond this, it was not possible to walk to the limit of the River Thames due to the southern field being severely waterlogged (Plate 15).



Plate 11 The arable fields to the north of Abingdon Road, wherein the roundabout is proposed (north facing).



Plate 12 The field to the south of Abingdon Road, showing the ridges and slope leading down to the River Thames (south facing).



Plate 13 Photograph taken from the southwestern tip of Scheduled Monument 1006345, looking west towards the scheme (individual standing on general location) (west facing).



Plate 14 Photograph taken from the southern limits of Scheduled Monument 1006345, showing the bank upon which, the monument is located and the northern tree boundary (north facing).



Plate 15 The field (river meadow/floodplain) through which the Scheme will cross, on the northern bank of the River Thames (southwest facing).

- 4.3.17 South of the River Thames, the southern floodplain was equally inaccessible, and the route of the Scheme was observed from Appleford Road. From the southern floodplain to Appleford Road the route passes through flooded extraction pits (Plate 16).
- 4.3.18 Moving south of Appleford Road, the Scheme continues across c. 600m of land, which has been subject to industrial gravel extraction (Plate 17) (Historic Landscape Characterisation HOX1166), to Appleford railway sidings. Beyond this, to the south of the sidings, the Scheme passes through an area of previous gravel extraction (Historic Landscape Characterisation HOX1168), to meet a lane that passes Hill Farm (Plate 18).
- 4.3.19 The remainder of the scheme was not visited due to water logging of fields.



Plate 16 View of the flooded extraction pits, between Appleford Road and the River Thames floodplain (north facing).



Plate 17 Looking south of Appleford Road across a large swathe of land that has been subject to gravel extraction (south facing).



Plate 18 The path that passes Hill Farm, with a flooded quarry cut (left) and an area of previous quarrying beyond the hedge line (right) (south facing).

4.4 Archaeological and Historic Background

- 4.4.1 There are two hundred and fifty seven cultural heritage resources recorded on Oxfordshire County Council's HER within the study area. Non-designated prehistoric to early medieval cultural heritage resources are prolific throughout the study area. These, combined with the Scheduled Monuments previously listed, show the study area to be an intensively occupied prehistoric to early medieval landscape. The Upper Thames Valley Survey, RCHME mapping, and a number of major archaeological interventions conducted within the Site have led to the identification of many of these resources and groups of resources (sites). These investigations are described below, followed by a description of heritage assets by period (Figure 4). The historic map sequence for the Site is provided on Figures 5 to 18.

Previous Archaeological Investigations

The Upper Thames Valley Survey and the Thames Valley Project

- 4.4.2 Knowledge of potential archaeological remains within the Site has greatly benefited from substantial works of aerial reconnaissance, mapping and analysis of visible cropmarks within the Thames Valley. In 1974 Oxfordshire Archaeological Unit produced a gazetteer of sites within the Upper Thames Valley, identified as cropmarks through aerial reconnaissance (Benson and Miles 1974). A second major synthesis, which interpreted earlier works and included new information from subsequent reconnaissance work, was produced by the Thames Valley Project, a joint programme between RCHME and English Heritage between 1988 and 1993 (Fenner and Dyer 1994). Reference to both bodies of work are found throughout this report.

Valley Park

- 4.4.3 As part of the proposed new development of Valley Park geophysical survey was conducted, followed by the excavation of 292 trenches in 2015 (EOX6365). These works identified activity from the late Palaeolithic and settlement from the Iron Age, including three foci of Iron Age/Romano-British settlement activity (in Fields 19, 21 and 23), and a fourth foci of possible Anglo-Saxon activity (Field 20). Several undated ditches were identified across the northern parts of the site, including within the scheme boundary. Based on alignments and fill characteristics of dated ditches, the northern ditches are interpreted as part of the extensive network of late Iron Age/Roman field systems. Extensive medieval and/or post-medieval ridge and furrow cultivation remains were also encountered across the site (Cotswold Archaeology 2015).

Didcot West Development

- 4.4.4 Prior to the construction of the Didcot West development (also referred to as The Western Alternative and the Great Western Park), a series of archaeological works were conducted, including desk-based assessment, walkover survey, field walking, geophysical survey, and trial trenching (EOX3419, EOX3290). This was then followed by an extensive archaeological evaluation on 199ha of land in 2002 by Cotswold Archaeology and fieldwork conducted by Oxford Archaeology between 2010 and 2012. The excavation produced significant archaeological results, including a Mesolithic flint scatter, early Neolithic pits, a Neolithic/early Bronze Age pond barrow, a group of middle Bronze Age roundhouses set within a system of ditched enclosures; a middle Iron Age settlement, Roman enclosures and trackways related to a villa (Cotswold Archaeology 2003, Oxford Archaeology 2015).

Didcot Technology Park

- 4.4.5 A geophysical survey was undertaken in 2017 as part of a site evaluation for a proposed Didcot Technology Park, north of Didcot (EOX6140). The survey confirmed the presence of likely archaeological features (including rectilinear enclosures, trackways and ancient settlement remains), whose presence had previously been indicated through cropmark analysis (Bartlett 2017).

Appleford Sidings

- 4.4.6 Excavations conducted in advance of gravel extraction between 1993 and 2000 revealed an extensive Bronze Age to Roman period landscape. Features included a Neolithic pit, group of cremations and an inhumation; a Middle Bronze Age landscape of trackways and field enclosures; a Roman settlement of high status, rectilinear field systems, more enclosures and trackways, and two cremation burials (EOX2568). The Roman component ceased to be occupied after AD 120. Roman boundaries and trackways continued in use in later Roman period and subsequent periods (Booth and Simmonds 2009).

Appleford Settlement.

- 4.4.7 Salvage archaeological work was conducted by a number of organisations within an area variously known as 'Appleford settlement' and 'Appleford Field', west of Appleford village. These works were concurrent with and in advance of a program of gravel extraction by Amey Group Ltd (Hinchliffe and Thomas 1980, 9). Prior to these works, aerial photography had shown cropmarks, representing pits and ditches of a settlement, covering an area of c. 20ha, dominated by a trackway system, radiating out in three directions from a central triangular, open area (Hinchliffe and Thomas 1980, 12). Prior to a major excavation conducted in 1973 gravel extraction had already uncovered a hoard of Iron age currency bars and a hoard of Roman pewter; observations during the gravel extraction recorded considerable remains; and two salvage excavations were conducted in 1969 and 1973 (Hinchliffe and Thomas 1980, 16-19).
- 4.4.8 The earlier works combined with the 1973 major excavation recorded substantial occupation and settlement, including Late Bronze Age pits, a sequence of mid-Iron Age enclosures, trackway, possible field boundaries, Roman ditched trackway, enclosure system, waterholes and small Early Medieval or Late Roman inhumation cemetery (Hinchliffe, J. and Thomas, R. 1980).

Bridge Farm

- 4.4.9 Here, cropmarks of rectangular enclosures and parallel lines were recorded in 1961. Subsequent clearances of Penn Copse destroyed a significant amount of archaeological remains. Subsequent quarrying has occurred after archaeological evaluations of the area. To the north of this excavations at 'Bridge Farm' revealed a middle Bronze Age cremation, a ring ditch and further Bronze Age ditches, Iron Age and Roman field systems and Iron L-shaped enclosure (Oxford Archaeology 2017, EOX6170, EOX6170).

Land at Culham, Geophysical Survey

- 4.4.10 In 2016 Headland Archaeology (UK) conducted an extensive geophysical survey, covering an area approximately 242 hectares, north of Abingdon Road as part of a baseline study to assess the archaeological potential of the area. The survey identified several archaeological zones/complexes, linear anomalies, likely representing field boundaries and other agricultural features within the proposed redline boundary (Headland Archaeology 2016).

Didcot Garden Town HIF1 Scheme, Geophysical Survey (Figure 19)

- 4.4.11 In 2020, Headland Archaeology (UK) conducted a geophysical survey of portions of the scheme detailed herein. Within these areas, anomalies, possibly of archaeological origin were identified south of Culham Science Park (Headland 2020).

Didcot Garden Town HIF1 Scheme, Trial Trench Evaluation

- 4.4.12 Trial trench evaluation and reporting was being carried out at the time of writing.

Palaeolithic

- 4.4.13 There have been occasional finds of Palaeolithic animal remains within the study area, all have been individual chance finds (find spots), with minimal or no contextual information. From south to north, a vertebra of a bos and the pelvic bone of an ox **[A34]** and three molars of a mammoth(s) **[A37]** were found west of the Didcot ring road, and a mammoth tusk **[A122]** was recorded east of Sutton Courtenay. A Palaeolithic flint flake was found north of the River Thames, at Burcot **[A199]**, and a small number of residual worked flints of Late Palaeolithic to Mesolithic/Early Neolithic date were encountered within the Valley Park excavations (Oxford Archaeology 2015, 39).

Mesolithic

- 4.4.14 There have been occasional occurrences of Mesolithic material found within the study area. When recorded, these have generally been as 'flint scatters' and residual flint found in later period features.
- 4.4.15 Prior to the construction of the Didcot West development, archaeological field walking recorded 53 items of worked flint, associated with burnt flint, which were broadly separated into Mesolithic/early Neolithic material and late Neolithic/Bronze Age materials **[A49]**. Subsequent excavations prior to development confirmed the presence of multi-period occupation and settlement, and included the shallow hollow 8m by 5m in the hillcrest **[A58]**. A small sample excavation of the material filling the hollow yielded c.100 worked flints in a fresh condition. The assemblage was dominated by small blades, and included a wide range of artefacts including primary, secondary and final knapping debris and a variety of flint tools, of which many had been subject to heating. The assemblage is interpreted as revealing a location where a small group may have gathered and knapped flint (Oxford Archaeology 2015). Mesolithic period activity in the area was also inferred from flint scatters as well as residual worked flint found in later period features **[A57]**.
- 4.4.16 To the north, at Appleford Sidings, archaeological works conducted prior to mineral extraction recorded a 'flint scatter', comprising flints dated to the Mesolithic period **[A72]** (Oxford Archaeology 2009, 11). The only other known instance of Mesolithic material within the study area was registered as having been found at Northfield Farm, southeast of Clifton Hampden. This consisted of a flint pick and flakes found in c.1930s **[A202]**.

Neolithic

- 4.4.17 The Scheme is located within a known, rich, Neolithic landscape, c. 3km east of the Neolithic Drayton cursus (and associated features) and c. 2km west of the Dorchester Cursus and henge. Of note here, excavations at the Drayton cursus revealed that part of the cursus was sealed by alluvium, which may have been deposited from the late Neolithic period (Ainslie and Wallis 1987, 1), suggesting that a similar phenomenon occurred elsewhere, with alluvium sealing and protecting additional Neolithic (and later) sites (ibid).
- 4.4.18 As previously mentioned, a considerable amount of mapping of visible cropmarks has been produced within the study area (Fenner and Dyer 1994; Benson and Miles 1974). Where cropmarks were identified, these were assessed and analysed, falling within feature categories such as 'enclosures', 'trackways', 'ring ditches', 'field systems' etc. The dating of these features is problematic, and without further archaeological investigation are interpreted as falling within broad date ranges (for example 'late prehistoric'). Where features are interpreted as 'late prehistoric', they are discussed below, under 'Neolithic', 'Bronze Age' and 'Iron Age' headings.
- 4.4.19 Based on the evidence, there was clearly Neolithic activity within the study area. Where excavation has identified Neolithic activity, this has taken the form of Neolithic land clearance, Neolithic pits, findspots, residual Neolithic material, an inhumation and a possible early round barrow or hengiform monument.
- 4.4.20 As part of the proposed Valley Park development, geophysical survey identified a series of anomalies, including a double-ditched polygonal enclosure, with internal ring ditches and a possible hearth feature **[A48]**, dated to the late prehistoric period. As part of the adjacent

Didcot West development archaeological works, field walking yielded Neolithic flint scatters and Neolithic pottery [A49]. Subsequent archaeological excavations recorded a multi-period occupation and settlement (assigned a site wide record as [A57]). The excavations here recorded several Neolithic pits isolated and in groups, although these fall outside of the study area. North of Wantage Road a Neolithic (c.3,500BC), a complete upturned bowl within a tree throw pit (removed tree stump) [A50] was recorded. This was interpreted as possible evidence of 'slash and burn' clearance of the post-glacial forest for pasture and/or early production of cereals. To the east of this an archaeological evaluation recorded late Neolithic/early Bronze Age pottery and flint, associated with animal bone assemblages, burnt lithics and charcoal [A51], including from within a pit. Approximately 2km northeast of this (also within the study area), an archaeological evaluation within Didcot identified a prehistoric ground surface, also with tree throw pits [A38]. Although no dating evidence was retrieved, these were also interpreted as representing Neolithic or Bronze Age land clearance activities. Of note, these were sealed by alluvium, 0.80m thick, thought to represent inundation from the later prehistoric onwards.

- 4.4.21 A series of, non-context, Neolithic finds are located within the study area, attached to a general grid reference, to encompass the general area [A52]. These include several Neolithic stone axes, a tanged dagger, and inhumation.
- 4.4.22 To the north of this, and within the proposed redline boundary, excavations at Appleford Sidings, recorded the presence of a Neolithic pit [A72], backfilled with worked flint and pottery (Booth and Simmonds 2009, 11). North of this, at 'Appleford Settlement', west of Appleford, a Neolithic polished stone axe [A98] was recorded. The absence of other Neolithic materials and features found during the Appleford Settlement excavations (Hinchliffe and Thomas 1980) suggests sporadic Neolithic activity, at best.
- 4.4.23 Further north, at Bridge Farm, Neolithic finds were recorded [A108] and [A120], including residual Neolithic worked flint, retrieved from later features (Oxford 2017, 9)]. In the fields adjacent to Appleford, within SM 100849, cropmark indicate a possible Neolithic rectangular enclosure [A74] and Neolithic to Roman enclosure and trackway [A228].
- 4.4.24 Running in an east-west band, on the northern banks of the River Thames, the 1993 Thames Gravels Surveys identified large areas of cropmarks, interpreted (in part) as 'later prehistoric' features. To date, these features have not been intrusively, archaeologically investigated. From west to east, these identified areas include an enclosure complex [A135]; two ring ditches to the southeast associated with pits, and linear features in the form of rectilinear and curvilinear enclosures [A144]; enclosure [A141]; and SM 1006345 (see above).
- 4.4.25 North of this band of identified cropmarks, but outside the proposed redline boundary, an area of further cropmarks, covering an area 169m by 244m, were recorded at Zouch Farm, [A119], possibly representing late prehistoric rectangular and sub-rectangular enclosures.
- 4.4.26 Late prehistoric features, dated to the Neolithic/early Bronze Age, have been archaeologically investigated in the fields to the north of the A415 (Abingdon Road), referred to here as 'Culham East'. c. 300m west of the proposed redline boundary, excavations identified a ring ditch with a 12.25m diameter, 1.96m wide and 0.98m deep [A148]. Its steep, v-shaped profile led the feature to be interpreted as an encircling ditch of a round barrow and not associated with a domestic enclosure. Early Neolithic pottery and a Neolithic leaf-shaped arrowhead were found in the fill of the ditch, leading excavators to suggest that the feature represent an early round barrow or a hengiform monument. No evidence was found of a surviving mound within the ditch circuit, but further ditches, pits and posthole were recorded within the ring ditch. Approximately 300m southwest of this an archaeological evaluation recorded a ditch containing pottery broadly dated to the Neolithic through to the middle Bronze Age [A136].
- 4.4.27 Several Neolithic to Bronze Age finds were recorded in the vicinity of these remains, including 45 unretouched flakes, cores, core fragments, knives, piercer, and arrowhead [A140]; Neolithic to Bronze Age flakes [A137] and [A149]. Just outside the proposed redline boundary Headland Archaeology's Land at Culham geophysical survey recorded a series of at least 10 enclosures over two, bordering, complexes, which were interpreted as belonging to the Neolithic to Iron Age periods [A151]. The western complex, Complex 5, comprised a series of anomalies indicating four enclosures, broadly aligned on a north to south axis; a sub-circular

anomaly which may represent a round house; and a high number of discrete anomalies suggesting settlement activity (Headland Archaeology 2016, 6). The eastern complex, Complex 6, comprised at least six enclosures along a southwest – northeast axis, with each successive enclosure slightly larger than the last. High magnitude anomalies within the enclosures are likely to be archaeological. At right angles to these, at least three further enclosures were identified (*ibid*). North of this and c.200m north of the redline boundary the survey identified further features including an irregular sub-circular enclosure and circular anomaly, possibly evidence of a roundhouse [A147] (*ibid*)

- 4.4.28 Moving east, Headland Archaeology's Land at Culham geophysical survey recorded two complexes, bisected by the railway line, including what may be a late prehistoric trackway and enclosure [A209]. East of this, either side of Abingdon Road, and firmly within the redline boundary, cropmarks recorded by the Thames Valley Project show an area 340m by 425m with a series of linear features (undated), suggestive of several large enclosures and trackways [A163]. Where geophysical survey was possible within this area, outside of wooded locations, as part of the Didcot Garden Town HIF1 Scheme Geophysical Survey, linear anomalies were identified, suggestive of a possible corner of an enclosure and associated ditch, west of the Culham Science Park entrance (Headland 2020). To the east, adjacent to Thame Lane, anomalies were interpreted as being possibly modern (*ibid*).
- 4.4.29 To the east of this, and crossing Abingdon Road, further cropmarks indicate a dense settlement complex of trackways and rectangular enclosures [A164]. These features have been dated as 'late prehistoric, but have not been intrusively, archaeologically, investigated.

Bronze Age

- 4.4.30 Bronze Age features and remains are well represented within the study area and include SMs that are in part designated for comprising Bronze Age barrow cemeteries. The foci of known Bronze Age remains and suggested remains through cropmarks, generally as ploughed out round barrows, lie either side of the River Thames, in the area around Bridge Farm, the fields surrounding Appleford, Fullamoor Plantation and Northfield Farm, and the fields west of Culham Science Park, north of the A415.
- 4.4.31 To the north of the A4130 archaeological excavation found evidence of late Bronze Age features [A27], in the form of a trackway extending north and west of the SM 1004853. Located east of this, are later prehistoric ditches and pits [A32].
- 4.4.32 Excavations south of the A4130 (from Milton Hill to beyond the proposed Science bridge crossing) have recovered Bronze Age remains and recorded Bronze Age features, throughout, albeit intermittently, with no apparent organised occupation. On the northern edge of Milton Hill have been recorded six small pits containing late Bronze Age pottery and animal bone. Radiocarbon dating was obtained from food residue within two of the vessels, providing a date 2858 +/- 30 [A41]. East of this, the Valley Park archaeological evaluation recorded late prehistoric pottery of potential Late Bronze Age to Early Iron Age date in features within Folds 5,8,16,18, 20 and 21, including postholes and ditches, from c. 120m south of the proposed redline boundary (Cotswold Archaeology 2015, 40). Bronze Age activity continues to the east, within the area of the Didcot West investigations [A57]. Here two middle Bronze Age ditches were recorded, one of which was located c. 250m south of the redline boundary, and within Area D, c. 620m south of the boundary there was evidence of late Bronze Age/early Iron Age pit, gully and ring ditch (Cotswold Archaeology 2003, 34). North of this, just south of the A4310, an archaeological evaluation recorded the presence of late Neolithic to early Bronze Age pit [A51].
- 4.4.33 Excavations at Appleford Sidings recorded the presence of a middle Bronze Age landscape comprising a field boundary ditches, enclosures, 17 waterholes, an inhumation burial and a group of cremation burials [A69] – [A72]. Although no clear evidence of a domestic settlement was identified, it is assumed that this would have lain nearby, with the field systems forming an intermediate zone between settlements and more extensive unenclosed landholdings beyond (Booth and Simmonds 2009, 120). To the north of this, between Appleford Sidings and Appleford Settlement a Bronze Age beaker burial (a vessel with an inhumation) was found in c.1862 in Appleford Field [A93]. Further north, within the Appleford Settlement site, Late

Bronze Age activity was represented as a series of pits, containing high proportions of flint tempered fabrics (Hinchliffe and Thomas 1980, 35).

- 4.4.34 To north of this, cropmarks at Bridge Farm **[A108]**, included a double ditched enclosure that was thought to be of Bronze Age date **[A107]**. During subsequent excavations, prior to quarrying, a middle Bronze Age cremation was recorded, that had marked similarities to a Roman bustum, wherein the individual appeared to have been placed on a pyre above a pit **[A108]**. West of this, during excavations associated with a proposed extension to the quarry, further Bronze Age activity was recorded **[A120]**. Within the south-eastern section of the evaluated area, middle Bronze Age ditches were identified and interpreted as representing enclosures of field systems or settlement (Oxford Archaeology 2017, 9). The upper fills of two of these ditches contained material more indicative of settlement activity, including well-charred cereal remains. To the northwest exploration of the ring ditch that had originally been identified through cropmarks **[A21]**, suggested that this may represent a Bronze Age Beaker period barrow. Middle Iron Age pottery was found within the upper fill of its ditch, suggesting that it had been left open for some period (ibid).
- 4.4.35 SM 1004849 is located c. 700m east of the proposed redline boundary and comprises a vast area (1205m by 1315m) of dense cropmarked ring ditches, rectangular enclosures and parallel ditches. Within this area three ring ditches have been identified by cropmarks, as **[A74]** and **[A73]**.
- 4.4.36 To the north of this, on the northern bank of the River Thames, SM 1421606 is listed as a 'Round Barrow Cemetery at Fullamoor Plantation'. The site comprises at least 10 ring ditches (barrows), and other features. The site was initially identified by visible cropmarks. In 1933 one disk barrow was excavated, which had a central pit with the remains of a cremation (surrounded by seven postholes). In 2013 Thames Valley Archaeological Services excavated eight early Bronze Age ring ditches and probable urn cremation **[A290]** as part of a substantial area evaluation (Thames Valley Archaeological Services 2013). C. 200m west of this SM 1006345 **[A119]**, is thought to comprise Late Prehistoric features. Of those visible features, none are circular, possibly indicating that the round barrow cemetery does not extend this far west. Further west of this still, and partly within the proposed redline boundary, cropmarks of an enclosure **[A141]** have been tentatively dated to the late prehistoric period. Circa. 550m west of this cropmark of two ring ditches associated with pits, rectilinear and curvilinear enclosures may indicate a continued presence of Bronze occupation **[A144]**.
- 4.4.37 Headland Archaeology Ltd conducted a geophysical survey in fields within and outside the redline boundary north of the A415, referred to here as 'Culham East'. These works recorded a series of least 10 enclosures over two complexes (Area 5, Complex 5 and 6) and a sub-circular anomaly, which may represent a round house **[A151]**; a semi-circular anomaly indicative of a small barrow or roundhouse with a cluster of discrete anomalies 50m to the south **[A150]**, 200m north of the redline boundary; and a possible ring gully, indicative of a round house, c. 200m north of the redline boundary **[A147]** (Headland Archaeology 2016, 6). In addition, the archaeologically investigated ring ditch **[A148]** described as possibly being a Neolithic feature, based on the Neolithic finds within its ditch fill, could alternatively be a Bronze Age barrow or roundhouse, with residual material in its fill. In addition, findspots of early Neolithic to Late Bronze Age lithics have been registered as **[A137]**, **[A140]**, **[A149]**.
- 4.4.38 Further to the east, areas of visible cropmarks may represent a continuation of the features visible at Fullamoor Plantation **[A109]**, including **[A163]** and **[A164]**.
- 4.4.39 To the east and south of the River Thames lies the extensive cropmark complex on Northfield Farm (SM 1002925). Geophysical survey and fieldwalking within this area by Oxford Archaeology identified at least one possible Bronze Age ring ditch as **[A201]** along with a significant amount of Mesolithic to Bronze Age worked flint and Bronze Age ring ditch **[A202]**. To the west of this, two Bronze Age ring ditches were identified as cropmarks **[A204]**.
- 4.4.40 A generic grid reference was given to findspots within the general area, which includes several Bronze Age remains **[A202]**. These include bracelets; a palstave; pottery; dagger; and an inhumation.

Iron Age

- 4.4.41 Iron Age remains are well represented throughout much of the study area. Previous excavations have demonstrated the existence of a series of Iron Age settlements, including at north of Milton Park, Milton Hill, Valley Park, Didcot West Development, and Appleford Settlement. Although Iron Age remains have been recorded in several additional locations, they are perhaps not comparable in terms of density and types of features as those areas listed. However, as already mentioned, a vast swathe of the study area includes archaeological remains suggested through cropmarks that have not been archaeologically investigated. Many of these features include enclosures, trackways, pits and ring ditches, and may represent further Iron Age settlement and/or activity.
- 4.4.42 To the north of the A4130, north of Milton Park, SM 1004853 contains a cropmark complex of circles and ditches occupying a considerable area, thought to represent an Iron Age settlement [A26]. Where archaeological investigations have occurred, Iron Age features were confirmed [A28] and [A27]. Further to the east an archaeological evaluation by Oxford Archaeology demonstrated dense Iron Age and Roman activity, suggestive of representing a considerable settlement, from the middle of the Iron Age [A31]. Large settlement enclosure ditches were identified, along with smaller boundary ditches, pits, gullies and postholes (Oxford Archaeology 2016). The archaeobotanical remains recovered included charred material indicative of arable farming and settlement, and the recovery of what was interpreted as parts of an oven structure was further evidence of domestic activity. Additional finds, common within a domestic setting included weaving combs. The frequency of intercutting features, including the enclosure ditches, suggests that the occupation of the settlement was multi-phase (ibid).
- 4.4.43 South of the A4310 an area 240m by 18m was archaeologically investigated as part of the Cleeve to Fyfield Water Main works. A considerable number of early to middle Iron Age features were recorded during these works, indicative of settlement remains [A41]. These included two roundhouses, one with a possible enclosure, as well as pits, postholes and two inhumations (Hart et al 2012, 215). Roundhouse 1 was 10m in diameter and associated with a boundary ditch and possible fence line. Roundhouse 2 was also 10m in diameter, and associated with an area of pits, possibly used for storage. Of these, one pit contained an infant burial with stone markers, and another contained a dump of animal bone. Two further roundhouses were dated to the Late Iron Age, including Roundhouse 2, which contained a central hearth pit, as well as further pits and postholes (Hart et al 2012, 216). Southeast of this, and part of the Cleeve to Fyfield Water Main works, three ditches were recorded, following the crest of Milton Hill, which may define an Iron Age hilltop enclosure [A44].
- 4.4.44 Evidence of an Iron Age settlement continued to the east, recorded within the Valley Park investigations. Here, three foci of Iron Age/Romano-British settlement activity were identified (in Fields 19, 21 and 23) [A54]. In Field 19, c.880m south of redline boundary, this comprised a probable enclosure and boundary ditches, pits and postholes, associated with abundant pottery and animal bone (Cotswold Archaeology 2015, 41). In Field 21, c.500m south of the proposed redline boundary, recorded features included a double-ditched polygonal enclosure, enclosure ditches and internal pits, postholes and ring ditches (ibid). And in Field 23, c.1.6km south of the proposed redline boundary, features included a rectangular enclosure with internal pits and a possible midden deposit (ibid). In addition to these foci, several undated ditches were recorded across the northern parts of the site, including within the proposed redline boundary [A54]. Based on alignments and fill characteristics of dated ditches, many of these could be part of the extensive, associated, network of late Iron Age/Roman field systems (Cotswold Archaeology 2015, 41-42).
- 4.4.45 Again, Iron Age activity continued east, to the Didcot West development. Field walking recorded Iron Age pottery [A49], and subsequent archaeological excavations revealed substantial evidence of Iron Age settlement, comprising early and middle Iron Age post-built roundhouses, ring gullies and pits [A57]. Alongside these, a large circular enclosure was recorded, with a diameter of 40m, containing at least one post-hole defined circular building, interpreted as representing some form of social distinction within the settlement [A61], a large rectangular post-built structure. A series of ditched boundaries, enclosures and rows of pits were also identified. A smaller rectangular enclosure was identified nearby, 20m by 18m, with few internal features, interpreted as possibly having had a non-secular function.

- 4.4.46 The middle Iron Age settlement is located southwest of Stephen Freeman Primary School and covers an area of 10 hectares **[A60]**. As well as circular post-built houses, four post structures and enclosures, an excess of 600 pits, some of which contained human burials were identified. Features were generally aligned and associated with a large north-south trackway, which may have begun in the Bronze Age and continued into the Iron Age **[A60]**.
- 4.4.47 North of Didcot, within the area referred to as Didcot Technology Park, a complex of cropmarks have been interpreted as a probable Late Prehistoric to Roman farmstead **[A36]**. The cropmarks appear to represent a 290m long trackway; three rectangular enclosures, defined by one ditch each, with features; further ditches and a group of 37 small circular features. Although excavation as part of a pipeline route, at the very northern end of the complex, did not record archaeological features, a geophysical survey of the full area identified magnetic anomalies interpreted as archaeological features (Bartlett 2017, 5). Two main rectilinear enclosures appear to be present, located between parallel north-south ditched trackways, associated with a number of silted pits (ibid).
- 4.4.48 To the north, the excavations at Appleford Sidings recorded late Iron Age to Roman occupation, comprising a rectilinear double ditched enclosure, around which lay an agricultural landscape that included a network of field boundaries and trackways (Booth and Simmonds 2009, 25). Iron Age occupation continued north, excavated as 'Appleford Settlement'. Excavations of some areas of the site revealed substantial Iron Age occupation, including enclosures, a four-post structure, associated postholes, pits (interpreted as storage pits), trackways and gullies, as well as domestic refuse **[A101]** (Hinchliffe and Thomas 1980, 42-43). The 1973 excavation revealed three phases of Iron Age polygonal enclosures and associated pits, which in its final phase was enclosed within a fenced/hedged area relating to a trackway (ibid). Prior to the excavations within the area, a hoard of six to twelve Iron Age currency bars were found within a hollow or ditch **[A100]**, possibly indicating a high-status occupation. Based on the cropmark evidence, the Iron Age occupation of this area was vast, covering some c.4ha. It is unclear how much of this area was in use at any given time, or whether there were multi-phases and shifts of occupation foci throughout the period (Hinchliffe and Thomas 1980, 108).
- 4.4.49 To the north of this, the Bridge Farm excavations recorded evidence of ditches forming Iron Age and Roman field systems **[A108]**, and to the west of this, works associated with the quarry extension recorded a middle Iron Age L-shaped enclosure **[A120]**.
- 4.4.50 To the east of this within the area of the Appleford SM 1004849 many of the cropmarks recorded here are interpreted as part of an Iron Age or early Medieval settlement **[A76]**. A salvage excavation conducted here in 1973 revealed a middle Iron Age sequence of enclosures and little to the west of this a possible Iron Age pit and gully were recorded **[A77]**.
- 4.4.51 On the northern banks of the Thames, from east to west, SM 1006345 consists of 12 or more overlapping rectangular enclosures, ditches and pits, some of which may be Iron Age. Similarly, the previously un-investigated enclosures **[A141]**, **[A142]**, and **[A144]** may represent Iron Age activity. To the east of these areas however, excavations conducted on SM 1421606 **[A109]** and **[A290]** recorded very limited Iron Age activity.
- 4.4.52 To the north of the Abingdon Road, in the area referred to as Culham East, geophysical survey identified several anomalies, which may represent Iron Age remains, including the enclosures that border, and cross the proposed redline boundary **[A151]**. East of this area, at Zouch Farm, a similarly undated complex of enclosures, and possible trackway may be of late prehistoric date **[A119]**.
- 4.4.53 Equally, further to the east, areas of identified cropmarks, such as **[A208]**, **[A163]**, and **[A164]**, may represent Iron Age settlement or activity. The types of features recorded, such as rectilinear enclosures, ring ditches, trackways and linear anomalies are indicative of late prehistoric activity.

Roman

- 4.4.54 The Scheme crosses an active and densely settled Roman landscape featuring the Roman town of Dorchester to the east and a major Roman settlement in Abingdon, minor settlements at Drayton, Long Whittingham, Appleford, Appleford Sidings, and west of Didcot.
- 4.4.55 Based on the results of various excavations conducted throughout the study area, and the scatter of non-contextual findspots, the area was a well utilised Roman landscape. Roman period ditches have been recorded throughout, interpreted as land boundaries and drainage ditches that functioned as parts of complex field systems. Roman wells are also prolific within the area, which are for the most part likely to have functioned as stock water, wherein water would have been drawn by bucket for distribution in troughs. Overall, where foci of Roman occupation are known, there was also an Iron Age concentration, indicating a general continuance of occupation. There are four instances of possible Roman villas within the study area, including Great Western Development **[A64]**; Appleford Sidings **[A72]**; Bridge Farm **[A107]**; and Appleford **[A76]**. Based on existing evidence there appears to be a concentration of Roman remains to the south of the River Thames, with very few clearly recorded Roman remains, north of the River. This pattern, however, may be misleading. Very few ground penetrating archaeological investigations have been conducted to the north of the River, and it is here that archaeological features seen as cropmarks, have frequently been interpreted as 'late prehistoric', based on their form. It is quite possible however, that the enclosures and linear features seen to the north are Roman and relate to a continuation of the field systems recorded to the south.
- 4.4.56 To the south of the A4130 substantial Roman occupation has been identified through archaeological investigation. Recent excavations within the area referred to a 'Milton Hill' (Milton Heights) recorded evidence of a Roman building, enclosures, and deposits possibly associated with cremation and associated rituals **[A43]** (John Moore Heritage Services 2017). Nearby, at least two Roman enclosures, several field-boundary ditches, and a well, 1.13m (diameter) by 1.80m (deep) were recorded **[A41]**. Late Roman features were less numerous, and consisted of field boundaries, an enclosure and pits (Hart et al 2017). One inhumation was recorded, an adult male buried in a prone position. Roman period ditches thought to function as field boundaries were recorded nearby **[A42]** and **[A44]**.
- 4.4.57 To the east of this, the Valley Park investigations recorded three foci of Iron Age/Roman settlement, with features including a double ditched polygonal enclosure, a probable enclosure and boundary ditches, pits, postholes and ring-ditches associated with Iron Age/Roman pottery **[A54]**. In addition, there was evidence of a Romanised building within the vicinity, based on the recovery of fragments of a ceramic box flue, slate, ceramic plate or oven, imbrex roof tile, and painted wall plaster (Cotswold Archaeology 2015, 40-41). To the north, within the low-lying areas, undated and dated ditches likely represent a wider field system connected to these settlements (ibid).
- 4.4.58 East of this, and partly overlapping it, the investigations in advance of the Didcot Western development recorded the badly robbed and plough damaged foundations of a late Roman walled 'villa' type building **[A64]**. The building was aligned northeast – southwest and was found to have a small hypocaust chamber, 3m wide, bounded by limestone walls and the remains of two tile pillars. The chamber had been backfilled with building rubble, which included keyed flue tiles, roof tile and painted wall plaster. Prior to this excavation, the area had already been flagged for its archaeological potential. In 1995 a hoard of 126 aurei were found here by a metal detectorist, which had been placed in and around a grey ware vessel. which resulted in a Treasure Trove designation. A subsequent find of over 100 bronze Roman coins, was then made within 40 to 60m of the original find. To the northeast of this the trackway and enclosure ditches were recorded **[A63]**. Within the northern enclosures three Roman wells were identified; all of which were over 2m deep. Additional wells were found associated with an east-west secondary track, and all were interpreted as having been used for stock water drawn by bucket for distribution in troughs). The driveway to the north **[A60]**, which had originated in the Iron Age, appeared to have continued in use through the Roman periods
- 4.4.59 The known Roman remains and inferred Roman features in the area referred to as North of Milton Park, are primarily characterised by Roman period field systems and possibly some

domestic settlement. Where archaeological investigations have occurred, Roman ditches have been recorded, which are likely to be part of wider field systems [A28], [A30] and [A32]. Where linear cropmarks have been recorded nearby, these may represent Roman field system ditches [A24] and [A25]. And an archaeological investigation conducted by Oxford Archaeology in 2016 identified what appears to be a middle Iron Age to late Roman settlement complex [A31] (Oxford Archaeology 2016).

- 4.4.60 A Roman cemetery also appears to have existed within the area. In c.1928 five inhumations were found during the construction of a railway siding, accompanied by 2nd and 3rd century pottery [A33]. And west of this, skeletons were recorded as having been found in a ballast pit that may have been dug during WW1, together with Roman pottery [A23].
- 4.4.61 To the north of this, at Didcot Technology Park, a complex of cropmarks have been interpreted as a probable Late Prehistoric to Roman farmstead [A36]. The cropmarks appear to represent a 290m long trackway; three rectangular enclosures, defined by one ditch each, with features; further ditches and a group of 37 small circular features. Although excavation as part of a pipeline route, at the very northern end of the complex, did not record archaeological features, a geophysical survey of the full area identified magnetic anomalies interpreted as archaeological features (Bartlett 2017, 5). Two main rectilinear enclosures appear to be present, located between parallel north-south ditched trackways, associated with a number of silted pits (ibid).
- 4.4.62 To the north, 'Appleford Sidings' had originally been flagged as a possible Roman villa enclosure and field system from cropmarks [A72]. Investigations confirmed the presence of a double ditched enclosure, rectilinear field systems, more enclosures and trackways, and two cremations (Booth and Simmonds 2009). The enclosure, which contained at least one rectilinear, timber, structure appeared to be in use up to AD120. The use of boundaries and trackways however, continued beyond this. The interpretation of the site as a villa was not fully accepted since the site appears to have been abandoned prior to its potential development as a villa. Roman field boundaries were also recorded nearby, to the southwest [A69].
- 4.4.63 To the north, and located within the proposed redline boundary, archaeological investigations at Appleford Settlement revealed considerable evidence of Roman occupation over a large area, including a ditch system defining a trackway, with associated enclosures on either side [A101], [A97] (Hinchliffe and Thomas 1980, 68). The suggested function of the trackway was one of controlling the movement of livestock, and although no access into the adjoining enclosure were identified, access may have been enabled by plank bridges (ibid). In support of this interpretation the environmental evidence indicates open grassland with some arable activity (Hinchliffe and Thomas 1980, 69). Within the enclosures themselves, it is likely that these contained domestic and/or agricultural buildings, although there is no firm evidence of structures. However, in one instance the alignment of postholes may be indicative of a timber building (ibid). In addition to these, wells (some with timber frames) and inhumations were recorded as well as ditches, inhumations, and a wicker-lined pit. The inhumations were recorded along the length of the trackway, of which eight were excavated. The area included two instances of Roman hoards, one a Roman pewter hoard of 24 items, c. 4th century AD, found during gravel extraction in 1968 [A99]. These may have been located at the base of a Roman well, based on a subsequent assessment of the context, and were accompanied by other finds including iron objects, pottery, animal and human bone, leather and vegetable debris (Brown 1973, 186). The other instance was a Roman coin hoard, found in 1954 during ploughing [A102] and consisting of over 5650 coins (c.320-370 AD), which were buried in two vessels. A little to the east of this, two skeletons were found alongside a Roman urn in 1842 [A92].
- 4.4.64 Further north, at the site of Bridge Farm, cropmarks of rectangular enclosures and parallel line recorded in 1961 were interpreted as a possible Roman villa [A107]. Part of the area (Penn Copse) was cleared by bulldozing 1962/3, which revealed buildings, a stone lined well or pits, associated with 1st to 4th century pottery. Since much of that area was destroyed, the extent or type of habitation could not be interpreted at that time. Subsequent investigations within the area have not found evidence of the presumed Roman villa on the site, but have found Roman ditches forming field systems, and some evidence for small scale Roman quarrying.

- 4.4.65 Another possible villa is recorded within SM 100849. Here, salvage work in 1980 over an area of 20ha produced finds and features [A76].
- 4.4.66 In the eastern margins of the study area, other foci of Roman activity have been identified within the area of **SM 1002925 [A219]**. Here in Northfield Farm the Iron Age settlement continued into the Roman periods. The site was initially identified through cropmarks, and occasional, targeted excavations have been conducted. Excavations in 1969 recorded Roman enclosure ditches, pits and a 3rd century inhumation. Further to the north of the scheduled area, the continuation of a Roman trackway was recorded through excavation [A200].
- 4.4.67 Approximately 700m east of the eastern end of the Scheme, north of Burcot, a Roman house (possibly a villa) was excavated in 1876 in a field called 'Tommy's Piece' [A197]. No further records exist of this villa.

Early medieval

- 4.4.68 Abingdon Abbey is located c. 2.25km northwest of the proposed redline boundary. A great deal is known of the Abbey owing to two 13th century manuscripts covering its first 500 years (the *Historia Monasterii de Abingdon*). According to these, the abbey was founded in c.675 by Cissa and then founded further by Ceadwalla and Ina, three successive kings of the West Saxons. It was originally established in honour of the Blessed Virgin, and supported 12 monks (Ditchfield and Page 1907, 51-62). The Abbey has a complex and varied history, including destruction by the Danes and subsequent rebuilding between 963 and 984 (ibid). By the time of Domesday the abbey held a large and rich portion of Berkshire, some of Oxfordshire, and manors in Gloucestershire and Warwickshire (ibid). Appleford was included within this, held in demesne to Abingdon Abbey, as recorded in 1086 (Page and Ditchfield 1924, 369-379). Prior to this however Appleford appears to have been part of the royal demesne, with King Alfred selling its five hides to Deormond, and from Deormond or his heirs it was passed to Abingdon Abbey, where it stayed until the dissolution of the monasteries in the 16th century (ibid).
- 4.4.69 On the opposite side of the River Thames, the river and Back Water form a small island, Andersey Island. The island was favoured by the royal houses of Mercia and Wessex. King Offa built a royal residence on the island and it was here that his son Egfrith died in 797 (Lobel 1962, 27-39).
- 4.4.70 There are three clear foci of early medieval occupation and remains within the study area. The area 'North of Milton Park' has clear evidence of settlement, with several grubenhauser (sunken feature buildings) both suggested through cropmarks and known through archaeological investigation. A cemetery has also been recorded associated with this. A second focus is Appleford and its surrounds, and the third focus is Sutton Courtenay, which falls largely outside the study area.
- 4.4.71 The area referred to as 'North of Milton Park' is one of proven early medieval settlement and cemetery. SM 1004853 contains cropmarks suggesting an open arrangement of grubenhauser (sunken feature buildings), with associated pits, field systems and enclosures [A26]. Where intrusive archaeological investigations have occurred nearby, early medieval remains have been found. For example, an unusually large number of early medieval pottery sherds were found within an abandoned grubenhaus [A27]; further occupation south of this [A28]; and a two grubenhauser with 6th century pottery, a bone weaving pick, animal bones and charred plant remains [A32]. The latter site recorded during an archaeological evaluation in 1995 also identified a small cemetery comprising 17 inhumations of men, women and children, with pottery indicating a 7th century date. The cemetery was expected to extend beyond the limits of the evaluation.
- 4.4.72 To the west, cropmarks indicate an area of pits, with possible additional grubenhauser [A23]; an additional early medieval burial found in 1920 [A29]; early medieval ditches and pits [A22]; and occasional pottery, which were interpreted as signs of activity on the edge of a settlement [A21].

- 4.4.73 South of the A4130, the Valley Park investigations recorded a possible grubenhaus, with associated spindle whorls [A54], on the eastern edge of Field 20, c. 1km south of the redline boundary (Cotswold Archaeology 2015, 42).
- 4.4.74 Associated with Appleford, SM 100849 [A76], within its considerable density of cropmarks is interpreted as being either (or both) and Iron Age or early medieval settlement. Within Appleford, human skeletons found associated with beads in 1890 possibly represents part of an early medieval cemetery [A89].
- 4.4.75 The area referred to as 'Appleford Settlement' was found to contain a small early medieval (or late Roman) cemetery [A103], comprising eight inhumations without coffins.
- 4.4.76 To the west of this on the outer limits of Sutton Courtenay, ditches were archaeologically investigated, although dating evidence was slight, a rare middle Saxon Ipswich Ware pottery fragment was recovered, which suggest high status occupation at this site [A124]. To the north of this, three inhumations were identified during early gravel extraction works [A126].
- 4.4.77 At the eastern end of the Scheme, during drainage works in 1865, in the field called 'Long Hadden and Yards', several human skeletons were found, associated with early medieval battle axes, swords and other similar articles of iron. The exact location of this find is uncertain, with two possible locations provided, as [A193] and [A194].

Medieval

- 4.4.78 The Scheme crosses five parishes located within the hundred of Ock and Dorchester. From south to north the scheme runs through the parish of Milton ('Middeltune' between 10th to 13th centuries; 'Middelton', 'Midelton' between the 13th and 15th centuries; and Mylton between 15th and 17th centuries), which in 1086 was in the hundred of Ock, and later within the hundred of Sutton (Page and Ditchfield 1924, 333-334). The Domesday Survey records 344 or 374 acres of meadow, with Milton surrounded by a rich agricultural district (ibid). The scheme then crosses through the parish of Didcot, which lies in the hundred of Moreton. There is no reference to Didcot by name in the Domesday Survey, and it is possible that at this point it was included in the four hides and a vigate held by a Henry de Ferres (Page and Ditchfield 1924, 471-475).
- 4.4.79 The Scheme then crosses through the parish of Sutton Courtenay ('Suttone', 'Suth tune' between the 9th and 12th centuries; 'Sugtun' in the 11th century; 'Sutton' between the 13th and 16th centuries; and 'Sutton Courtney' in the 15th century), also in the hundred of Ock. The parish contained the township of Sutton Wick and the chapelry of Appleford.
- 4.4.80 To the north of the River Thames, the Scheme lies within the hundred of Dorchester, within which was the site of the first episcopal see of the West Saxons (Lobel 1962, 16-27). Of the villages within the hundred, Culham (Cula's hamm) was a place of importance due to the popularity of Andersey Island. After the conquest the royal residence was frequented, as a hunting lodge by William I and William II. During the reign of Henry I, however, the island and its building were returned to Abingdon (ibid).
- 4.4.81 The Scheme then passes through the modern parish of Clifton Hampden (made a parish in 1819). Prior to this, Clifton was a chapelry of Dorchester (ibid). The road connecting Dorchester and Abingdon (Abingdon Road), which passes through Culham and Clifton Hampden, is a 'highway of great antiquity' (ibid). Records indicate that the road had been neglected in the 16th century (ibid).
- 4.4.82 The name Clifton is Anglo Saxon in origin and means 'turn on a cliff'. Maps dated to the 17th and 18th century label the settlement as Clifton (Clyften), and there is no documentary evidence for the use of 'Hampden' until 1726 (Lobel 1962, 16-27). The addition of 'Hampden' may reference the lord of the manor (Miles Hampden), who was lord in the 1530s (ibid). Although there is little information as to the village's system of landholding until the 13th century. In 1086 (Domesday) Clifton was included in the lands of the Bishop of Lincoln's Dorchester Manor (ibid).

- 4.4.83 Ridge and furrow features, drainage ditches, and field boundaries are commonly identified in archaeological investigations and cropmark analysis within the study area. Medieval to post-medieval ridge and furrow features have been recorded North of Milton Park [A30], south of the A4310 [A51], and in Valley Park, along with field drains and ditches identifying former field boundaries [A54]. To the north of this, similar features were found during investigations near Appleford Sidings [A69] and [A77].
- 4.4.84 The geophysical survey undertaken north of Abingdon Road within the Clifton Hampden section of the Scheme by Headland Archaeology identified broad linear anomalies in Fields 9, 10, 25 and 26. Such anomalies are characteristic of medieval and post-medieval ridge and furrow cultivation (Headland Archaeology 2016, 4).

Post-medieval

- 4.4.85 Abingdon Road is a 'highway of great antiquity' (Lobel 1962, 16-27), possibly medieval or earlier in origin, and was the parish's main means of communication. The highway appears to have been neglected in the 16th and 17th centuries (ibid). By 1736 the road was in a ruinous state and by an act of parliament a turnpike trust and empowered it to levy tolls for the maintenance and repair of the road (ibid). The exact route of the highway may have changed over time. Indeed, maps of the late 18th century show a slightly different route as the road enters Clifton.
- 4.4.86 Christopher Saxton's map of c. 1600 shows the location of the Thames, its main tributaries, the locations of bridges and settlements. The place names are listed as follows: Didcot, Sutton Courtney, Apleford, and Clyfton. Although the course of the River Thames does not follow its current course, this may be more due to inaccuracies in the map rather than representing the actual course. Emanuel Bowen's map of 1756 shows the River Thames following its existing course, but appears to put Apleford in the wrong location, and does not map the location of Didcot. John Rocque's map of 1761 provides a detailed map of the settlements, paths, ditches, fields and other features. Apparent from Rocque's map is how significantly the landscape altered with the construction of the railway, particularly with the 19th and 20th century transformation of Didcot and Appleford. However, what is clear from Rocque is that during the mid-18th century the study area was occupied by fields, either side of the River Thames (also known as the River Isis). From south to north the Scheme crosses 'Horse Lease', now referred to as Moor Ditch. As it moves north, the Scheme crosses an east-west path which connects Sutton Courtney and the Main Road. Further north a second path crosses the Main Road, known as Port Way, and further north of this the Scheme crosses Appleford Road, linking Appleford to Sutton Courtenay. South of the River Thames, a considerable width of floodplain is shown. To the north of the River Thames less detail is mapped (being outside of the County of Berkshire). Such detail, however, can be seen on John Andrews and Andrew Dury's map of 1774, where north of the River, the Scheme crosses Culham Field, to join Abingdon Road. North of Fulmoor Farm the Scheme crosses fields and part of Culham Heath. The north-south road north of Clifton appears on a slightly different alignment to the existing Oxford Road, and it is possible that this path runs partly through the eastern end of the Scheme.
- 4.4.87 The Great Western Railway opened its Bristol to London Paddington line in 1840, which passed through Didcot. A branch line through to Oxford, stopping in Appleford and Culham station (originally named Abingdon Road station) which was then constructed and opened in 1844 (Ditchfield and Page 1923, 471-475).
- 4.4.88 North of Abingdon Road, within the Clifton Hampden Bypass section of the Scheme, Headland Archaeology conducted an extensive geophysical survey. Broad linear anomalies were identified in Fields 9, 10, 25 and 26. Such anomalies are characteristic of medieval and post-medieval ridge and furrow cultivation (Headland Archaeology 2016, 4).

Modern

- 4.4.89 Much of the landscape which the Scheme crosses has been heavily altered in the 20th and early 21st centuries. Aside from the considerable enlargement of Didcot and the development of Culham Science Park and Milton Park, major features have included: the construction and demolition of Didcot A Power Station; the substantial extraction of gravels between Didcot and

the River Thames; and the construction and demolition of HMS Hornbill (the WWII airfield that was subsequently developed as Culham Science Park). All three of these features will have had considerable impact to below ground archaeological remains. In the case of the power station and gravel quarries, the removal of below ground deposits is likely to have reached the natural bedrock, thereby removing all archaeological deposits.

- 4.4.90 Culham Science Park is located on the site of a former military airfield, which was opened as a Royal Navy Station in 1944 and was known variously as RNAS Culham and HMS Hornbill. The airfield was occupied by the Royal Navy Number 2 Aircraft Receipt and Dispatch Unit and comprised at least 32 hangers and three linear concrete and tarmac runways, a three storey Navy control tower and a number of associated facilities (Pastscape, monument number 1393286). The airfield was closed in 1953 and was then used by the Atomic Energy commission from 1960.
- 4.4.91 The airfield's runways are still apparent in the complex's current, triangular form. Thame Lane surrounded the runways, used as the route for the aircrafts to and from the hangers and aircraft standing to the runways. The hangers and aircraft standings were located to the north, southeast and southwest of Thame Lane. The hard standing and foundations of these structures and routes are likely to have survived in part.

4.5 Historic Landscape (Figure 2)

- 4.5.1 The Scheme crosses two Oxfordshire districts: the Vale of White Horse and South Oxfordshire. South Oxfordshire and the Vale of White Horse Districts are predominantly rural, characterised by Enclosures, Woodland, and Rural Settlement. Within South Oxfordshire enclosures are the most common broad type, at 71%, of which re-organised enclosures and prairie/amalgamated enclosures are the most frequent (276). Within the district, industrial sites cluster around the towns and the River Thames (ibid). Within the Vale of White Horse enclosures are also the most common broad type, at 75%, of which reorganised enclosures cover more than a third of the District (280).
- 4.5.2 To the south of the River Thames, the Scheme crosses the following broad types: 'Enclosure', 'Civic Amenities', 'Industry' and 'Rural Settlement'. Within these, the following historic landscape character (HLC) types, the following are represented:
- Rural Settlement - Rural Farmstead (1811-1881);
 - Enclosure - Re-organised Enclosure (1921 – 1999);
 - Enclosure - Planned Enclosure (1811 – 1881);
 - Civic Amenities – Utilities;
 - Civic amenities – Waste Disposal;
 - Industry – Flooded Extractive Pits; and
 - Industry – Extractive Works.
- 4.5.3 Of these, the enclosures and rural settlement are located south of the A4130 and in a small land parcel north of Didcot. These are primarily reorganised enclosures created through the construction of the A4130, but also includes Rural Farmstead (HOX4964), which relates to the farmhouse and surrounding gardens of New Farm.
- 4.5.4 Elsewhere south of the River Thames, 'Civic Amenities' and 'Industry' dominate and are characterised by the former power station and landscapes created by gravel quarrying, which has resulted in areas of landfill and flooded extractive pits. These features now extend as far as the southern bank of the River Thames.
- 4.5.5 To the north of the River Thames, the Scheme crosses the following broad types: Enclosure, Industry, Woodland and Civic Amenities. Within these, the following historic landscape character (HLC) types, the following are represented:
- Enclosure - Re-organised Enclosure (1921 – 1999);
 - Enclosure - Re-organised Enclosure (1798 - 1810);

- Enclosure - Planned Enclosure (1811 – 1881);
- Industry – Industrial Estate (1960 – 1999);
- Industry – Industrial Estate (1921-1999);
- Woodland – Secondary (1921 – 1999);
- Woodland – Secondary (1700 – 1797); and
- Civic Amenities – Sewerage Treatment (1921 – 1999)

Of these, reorganised enclosures (1921-1999) and industrial estate dominate. At the northern end of the Scheme, the Site borders secondary woodland (1700 – 1797) (HOX 1085).

4.6 Previous Ground Disturbance

- 4.6.1 Differential levels of previous ground disturbance are expected along the length of the Scheme. Where historic landscapes have been recorded as Civic Amenities (Utilities and Waste Disposal) and Industry (Flooded Extractive Pits and Extractive Works) (see Section 4.5), the magnitude of previous ground disturbance is considered to be high to very high, resulting in the potential for archaeological deposits to have been removed. Of note, areas to be included in this category include the Minscombe site, south of the A4130, which historically was a sewage disposal works, and the lands adjacent to the southern bank of the River Thames, wherein gravel extraction has continued.
- 4.6.2 Areas where this high level of ground disturbance are considered to preclude any archaeological potential are shown on Figure 21.
- 4.6.3 Elsewhere, within areas characterised as 'Enclosure', the magnitude of previous ground disturbance is considered low.

5. Assessment of Baseline

5.1 Introduction

- 5.1.1 The following assessment draws on the information contained in the baseline and assesses the significance of assets with the potential to be impacted by the Scheme. It also assesses the degree of previous ground disturbance within the redline boundary and proceeds to discuss the area's archaeological potential.
- 5.1.2 For the purposes of the following assessment, assets have been grouped according to their shared functions, locations, settings and/or interests as appropriate, although all assets are described individually in Appendix 7.1.

5.2 Designated Heritage Assets

Scheduled Monuments

- 5.2.1 As previously noted, there are no Scheduled Monuments within the Site, however five Scheduled Monuments are located within the study area, these comprise four settlement sites and one round barrow cemetery:
- **Settlement Site SM 1004853, [A25, A26 and A28]**
- 5.2.2 Scheduled Monument 1004853 covers an area 580m by 405m and is located approximately 770m north of the Site and north of Milton Park. The monument is labelled as a 'settlement site' based on identification and interpretation of cropmarks. Based on their typology, these cropmarks are thought to date from the Iron Age, Romano-British and Early Medieval periods. Archaeological investigations have been conducted within and around the area of the SM. These have identified a ladder enclosure, possibly dating to the Iron Age and a zone of multiperiod occupation from the Iron Age to Early Medieval period (Cotswold Archaeological Trust, 2000). A subsequent evaluation was conducted within the area of the SM in 2008, revealing occupation spanning the Late Bronze Age to Early Medieval periods, with some possibly intrusive Post-medieval features (Williams, 2008).
- 5.2.3 The monument is located some distance from the Site, separated by the Milton Park development, railway line and the A4130. This asset and its setting are not expected to be impacted by the Scheme.
- **Settlement Site SE of Church SM 1004849, [A76]**
- 5.2.4 Scheduled Monument 1004849 covers an area 1,210m by 730m and is located approximately 500m east of the Site, east of the railway line and Main Road, and southeast of Appleford. The monument is labelled as a 'settlement site' based on identification and interpretation of cropmarks, comprising ring ditches, rectangular enclosures and parallel ditches, representing an Iron Age to Early Medieval settlement. The Royal Commission on Historical Monuments of England (RCHME) project recorded this area as an extensive multi-phase complex of features including a Roman villa and associated features including trackways, field boundaries, ditches, and three small round pits. A group of five Bronze Age round barrows, a square and rectangular enclosure, and a settlement area of hut circles, enclosures and field boundaries of unknown prehistoric date were also noted (John, 1999). Salvage work was conducted on 20ha of the cropmarked area, revealing features indicative of Iron Age and Roman periods, including a hoard of currency bars and of Roman pewter, Late Bronze Age pits, Middle Iron Age enclosures and a Roman ditched enclosure. This area is now destroyed (Hinchliffe and Thomas, 1980). In 2009 the condition of the monument was recorded at risk, with 'extensive significant problems, i.e. under plough, collapse' and the trend as 'declining', with principal vulnerability from arable ploughing.
- 5.2.5 The monument is located some distance from the Site, separated by the railway line and Main Road. This asset and its setting are not expected to be impacted by the Scheme.
- **Settlement Site N of Thames SM 1006345, [A117]**

- 5.2.6 Scheduled Monument 1006345 covers an area 375m by 230m and is located c.220m east of the Site. The monument is labelled as a 'settlement site' based on identification and interpretation of a dense complex of cropmarks, comprising a dozen or so rectangular enclosures, some overlapping, as well as ditches and scattered pits. These include a rectangular enclosure, 150m by 100m, with an entrance to the east, with an internal, irregular oval enclosure with entrance, and pits. A scatter of worn worked flints have been recovered from the plough-soil within this area. No archaeological investigations have to date, been conducted within or around this monument.
- 5.2.7 Due to proximity there is the potential for change to the setting of this asset.
- **Round Barrow Cemetery at Fullamoor Plantation SM 1421606, [A109]**
- 5.2.8 Scheduled Monument 1421606 covers an area 690m by 370m and is located c.750m east and 470m south of the Site. The monument is an Early Bronze Age round barrow cemetery, now levelled to buried ring ditches visible as crop marks. Reasons for the monument's designation are:
- Rarity (barrow cemeteries are sufficiently rare nationally that there is a presumption in favour of scheduling those that are relatively complete/retain archaeological remains);
 - documentation/finds (aerial photography, archaeological survey and excavation has provided good evidence for the survival of nationally important archaeological features and material culture has been recovered, related to its use as a Bronze Age funerary site);
 - survival (the ditches have been found to have survived well and to a significant depth);
 - diversity (a range of types of barrow remains survive, including barrows that share similarities to late-Neolithic barrows; an unusual disc barrow; and a multi-phased double ditched barrow); and
 - potential (there is the potential for funerary deposits and artefacts to exist, which could inform on the traditions of the period).
- 5.2.9 The monument is located some distance from the Site, separated by the railway line and Abingdon Road. This asset and its setting are not expected to be impacted by the Scheme.
- **Settlement Site at Northfield Farm SM 1002925, [A219]**
- 5.2.10 Scheduled Monument 1002925 covers an area 1,769m by 2,216m and is located c.800m south of the Site. The designated area corresponds to **[A219]** and comprises an Iron Age and Roman settlement, as well as burials dating from the Bronze Age through to the 3rd century AD (Roman period). The western portion of the scheduled area contains two distinct systems of trackway and enclosures on different alignments, with the latter dating from late 1st and 2nd century AD. In the southern portion of the scheduled area, there is a related trackway, which is central to a complex of enclosures. In the eastern portion there is a palisade, pits, enclosures and a triple ditched feature. Excavations within the area in c.1969, 1976 and 1981 identified a Bronze Age barrow, cremations and inhumations, parallel ditches cut by Roman features, Roman enclosure ditches, pits and inhumation. The condition of the site was assessed in 2009 and placed on the 'at risk' register. Its condition was reported as 'extensive significant problems, i.e. under plough, collapse', with the trend of 'declining', principally through arable ploughing.
- 5.2.11 The monument is located some distance from the Site, separated by Clifton Hampden, the River Thames and the A415. This asset and its setting are not expected to be impacted by the Scheme.

Registered Parks and Gardens

Nuneham Courtenay Registered Park and Garden

- 5.2.12 Nuneham Courtenay Park and Garden is registered at Grade I **[A207]** and part of its extent falls within the study area for this assessment. The park and garden is located adjacent to the west side of the village of Nuneham Courtenay. It was laid out in three phases in the 18th century:
- 1760s, the first Earl Harcourt's classical landscape to offset his Greek 'temple' (church);

- William Mason's picturesque landscape of 1777 for the second Earl (Mason having laid out a famous flower garden here in 1771); and
 - the parkland laid out by Lancelot Brown 1779-82 (supervised by the second Earl and Mason), when he also laid out Brown's Walk in the pleasure grounds.
- 5.2.13 In the 19th century the garden was extended when more land was acquired to the east. A pinetum and other work was carried out by W. S. Gilpin in 1832 and there are 19th and early 20th century terraces adjacent to the house.
- 5.2.14 Only two outlying listed buildings within the boundary of the registered park and garden (RPG) fall within the study area of this assessment; the Grade II listed Keeper's Cottage **[A205]** and Venison House **[A206]**. However, the RPG contains 26 listed buildings in total, comprising the house and designed park and garden features of Nuneham House and Nuneham Courtenay Arboretum (see Table 5.1). Nuneham House is Grade II* listed (NHLE 1286179) and forms the focal point of the estate, surrounded by an 18th century landscape park and pleasure ground. Many park features are listed buildings and these include the Grade II* listed Church of All Saints (NHLE 1286134) and the Grade I listed Carfax Conduit (NHLE 1193569) which is also a scheduled monument (NHLE 1020965). Whilst these features are outside the formal study area for this assessment, the assets and the designated parkland have one designed setting and therefore the assets within the park are considered within the assessment in so far as they contribute to the value and purpose of the RPG, and where they may feature in any key views that may be impacted by the proposed scheme.
- 5.2.15 The park and garden benefits from a detailed designation description that provides information on the history of the park's development, key features and its designed key views. These are outlined below:
- Nuneham House was deliberately sited on a wooded knoll above the River Thames to take advantage of the views west down to the water and towards Abington, north towards the pleasure ground and All Saints Church with the backdrop of Oxford's dreaming spires and the broad countryside beyond. The house is flanked by quadrant links and connected pavilions, which together surround three sides of the entrance courtyard to the east, overlooking the east lawn. The views were capitalised upon in later phases of the garden development when terraces were added to the south, north and west sides of the house in the 19th century, as part of Gilpin's work. A path leads from the terrace on the north front towards All Saints' church and Mason's Garden within the northern pleasure grounds.
 - William Mason's Garden, an informal grouping of flower borders within lawn, is surrounded by trees and shrubs, with various small structures and buildings occurring as incidents along the perimeter circuit walk. Some of the original built features have gone, but the Temple of Flora remains a dominant feature, lying on the east boundary of the garden, 160m north-east of the House.
 - The second Earl wrote his own guidebook stating that his landscaped garden was to be seen and appreciated like a Gilpin picturesque tour with defined stations for viewing the Thames Valley landscape north, west and southwest of the House. A key view he identified was one west towards Abingdon church spire set against the Berkshire hills.
 - Brown's Walk, laid out by Lancelot Brown in 1779, lies south of the House on the west-facing slope above the river. It is a curving, looped woodland walk from the House. The southernmost end of the walk overlooks a small, steep valley, and on the opposite hillside (Brown's Hill), in open pasture, stands the Carfax Conduit as an eyecatcher within the park.
 - All Saints' Church is sited on a promontory 200m north-east of the House and overlooks the river to the west and north, and beyond this enjoys views towards Oxford and its surrounding hills to the north, and Abingdon to the west. Lawns slope steeply away to the west and north, to the edge of the pleasure grounds, and a straight terraced path, sited at the top of the north slope, runs along the north front of the church and beyond to the east for c 100m. It was one of the first churches built as a garden ornament, when first built it was reached by a straight avenue walk north from the House. The dome was used as a rotunda, appearing to surmount the orangery in Mason's Garden, below to the south.

- Beyond the formal pleasure garden, the park surrounds the House, consisting of pasture and arable land, and woodland which is largely sited on the boundaries. The steep slope to the west leads down to the river, with extensive views to the west and north. The central area gives views south and south-east towards the Sinodun Hills north-west of Wallingford, and the surrounding countryside.
- The Harcourt Arboretum was laid out as a pinetum in the 1830s by Gilpin, in order to grow the North American conifers being introduced at that time. He used similar promontory-type planting of shrubs in the ridings to that which he had used in Mason's Garden. The Arboretum is now managed as a satellite garden of Oxford University Botanic Garden, with mature trees and informal shrub beds within grassed woodland rides.
- The current north drive, laid out in 1904, enters the park via an approach road from the centre of the village of Nuneham Courtenay. The drive begins around 900m north-east of the House, running south-west along a hedge and tree-lined route towards the house. It passes a small, single-storey lodge and a lake to the west (the old village pond, enlarged in the late C18). A spur west from the drive, at the south end of The Lake, gives access to Home Farm and the walled garden. The main course skirts to the east and south of the walled garden, running in a straight line along the remains of a broad lime avenue to reach the early 20th century Manor Lodge, east of the House. Passing to the south of the Lodge, the drive extends west down a shallow grass slope, before dividing into two to enter the forecourt east of the house at the north-east and south-east corners.
- Prior to the 1830s the main drive during the C18 entered the park at a point to the south end of Nuneham village street. Remains of this former drive exist south of the present drive, which it joins. From the 1830s, the main ornamental drive, now largely disused, entered the park 1.5km north-east of the House, giving access at its north end to the Arboretum. A single-storey stone lodge lies to the south of the entrance. The drive runs south-west through the Arboretum, crossing the park to join the north drive at the east end of the lime avenue.
- The south drive, now disused but before 1900 the principal entrance from London, enters the park 2km south-west of the House, past the site of the Abingdon Lodge (now demolished). The drive curves north-east through the park, with views to the west, south and east opening up at various points, and finally joining the main drive by Manor Lodge.
- At the north-west corner of the park, a ferry over the river (now gone) gave direct access from Abingdon and the west bank of the river, past Ferry Cottage. The drive from there runs east and south, ascending the steep slope from the river into the park, passing the stables and walled garden, and joining the main drive by Manor Lodge.

5.2.16 The significance of the park derives from its artistic and architectural interest as an example of an 18th century designed landscape, comprising a pleasure ground and parkland, together with an 19th century arboretum. The parkland inspired works of art; being painted by a young William Turner in 1787, and, rather negatively, it is credited with inspiring Oliver Goldsmith's poem 'The Detested Village' which condemned rural depopulation and the indulgence of the rich. It was published in 1770 after Goldsmith witnessed the removal of the original Nuneham village to make way for Mason's garden in 1761. The parkland has historical interest due to its association with the Harcourt family and their patronage of nationally significant architects and landscape architects to design the park and its buildings in several phases. Most notable amongst them is Lancelot 'Capability' Brown, and a plan of the garden he designed survives to strengthen understanding of this connection (Stroud, 1984). The list of associated designers also includes William Mason, William Sawrey Gilpin, James Stuart, Henry Holland and Stiff Leadbetter, all of whom were key pioneers of architecture and garden design. William Mason's, flower garden at Nuneham, dated to 1771, was viewed as 'a revolution in taste and sentiment', for example. Archaeological interest is also provided by the presence within the parkland of the aforementioned Nuneham village, as well as parts of the parkland garden that may have been lost, altered or overgrown in the course of the last two centuries.

5.2.17 The setting of the garden includes its siting, approaches and carriage drives, as well as any designed key views of, from and within the garden. The 470ha estate is bounded to the west by the River Thames, and on the other sides largely by agricultural land and woodland which restricts long views into and out of the park on the east and southeast sides. The largely rural setting also includes Culham scientific laboratories to the south. The park overlies low,

undulating hills, with a steep slope towards the west boundary where the land drops down to the river. Important long views look west towards Abingdon and north towards Oxford. As the description of the development and key features of the garden provided above demonstrates, the focus of views from within the garden looking out was directed predominantly to the north and west over the landscape and to the river. Other views are inward looking within the garden and along its drives and footpaths. The thick woodland belt along the south and east side of the garden provide an enclosing aspect to that side. This woodland is depicted on Lancelot 'Capability' Brown's plan of the estate from 1779 (Stroud, 1984 plate 60a).

- 5.2.18 The park and garden contains, and provides the setting for, the listed buildings within it, which form part of the designed landscape. The listed buildings within the park are detailed in Table 5-1.

Table 5-1 Listed buildings Nuneham Courtenay Park and Garden

Report Ref.	NHLE number	Name/Description	Type	Grade
A205	1048050	The Keeper's Cottage	Cottage	II
A206	1286105	Venison House 60m northwest of the Keepers Cottage	Venison House	II
Outside study area	1193569	Carfax Conduit	Conduit, now an eyecatcher	I
Outside study area	1048045	Terraces, South, West, and North of Nuneham House	Garden terrace	II
Outside study area	1048046	South section of forecourt wall at Nuneham House	Garden wall	II
Outside study area	1368715	Central section of forecourt wall at Nuneham House	Garden wall	II
Outside study area	1286179	Nuneham House	House	II*
Outside study area	1193424	North section of forecourt wall at Nuneham House	Garden wall	II
Outside study area	1193479	Well head 5m northwest of Nuneham House	Well	II
Outside study area	1193557	Urn 40m north of Nuneham House	Urn	II
Outside study area	1048049	Urn 70m northwest of Nuneham House	Urn	II
Outside study area	1048048	Well head 50m west-north-west of Temple of Flora	Well head	II
Outside study area	1368717	Grotto and rockery 40m south of Temple of Flora	Grotto	II
Outside study area	1286127	Rockery 40m south of Temple of Flora	Rockery	II
Outside study area	1193524	Column and Vase 20m southwest of Temple of Flora	Column and Vase	II
Outside study area	1368716	Temple of Flora 160m northeast of Nuneham House	Garden Temple	II
Outside study area	1193586	Dairy Cottage	Cottage	II

Outside study area	1048047	Pollard Memorial 15m east of Church of All Saints	Memorial	II
Outside study area	1286134	Church of All Saints	Church	II*
Outside study area	1368718	Gate to Walled Garden 400m east of Nuneham House	Gate	II
Outside study area	1133508	Statue of Doctor Fell 130m northeast of Church of All Saints	Statue	II
Outside study area	1368719	Icehouse 140m southwest of the Rectory	Icehouse	II
Outside study area	1048051	The Rectory	Rectory	II
Outside study area	1193582	Entrance gates to Nuneham Arboretum	Gates	II
Outside study area	1048053	Nuneham Courtenay Oxford Lodge	Lodge	II

- 5.2.19 The listed buildings within the assessment area are the Grade II listed Gamekeeper's Cottage **[A205]** and the Venison House **[A206]** which are located as a small building cluster within the parkland, around 950m to the south-east of the House. Both buildings have architectural and historical interest as late-18th century, functional, yet also aesthetic elements of the wider estate parkland round the house. The buildings' architects are not known. Both are accessed via an offshoot from the south drive. The buildings are contained within their own garden plots and back onto the Black Wood Planation to their east side and further dense woodland planting located around 350m to the south. The woodland planting screens views out of the park on the east and southeast sides from these buildings and their setting.

Conservation Areas

▪ Clifton Hampden Conservation Area –

- 5.2.20 Clifton Hampden Conservation Area **[A224]** contains 26 listed buildings including the Grade II* listed buildings at the Church of St Michael and All Angels **[A185]**, with elements dating to the 12th century, and Clifton Hampden Bridge **[A178]**, designed by Sir Gilbert Scott. The remaining assets are Grade II listed and mainly focused on the main thoroughfares through the village on Watery Lane and High Street. The settlement has early medieval origins, but its character and appearance today is of a late-medieval to early-modern rural settlement. Several buildings date to the 16th and 17th centuries and display timber-frame and thatch construction, such as Bridge End Cottage and Mesopotamia Cottage **[A182; A189]**. Later buildings are predominantly brick-built and non-designated, but they add to the character and appearance of the area. Large individually designed houses with large garden plots on Watery Lane give way to more tightly-packed smaller properties at the north end of High Street, whilst towards the river the area opens out again with larger thatched buildings and green spaces with mature trees. The village has an informal, rural character with mature trees, hedges and gardens forming an important setting and backdrop to the buildings. The streetscapes comprise cottages and buildings, which, although sharing a similar domestic scale and materials pallet, have nevertheless a subtly varied and individual appearance with mixed elevations comprising brick of different bonds, stone, and timber frame, bays, dormers windows, porches, outshuts and a roofscape of hipped, gabled and pentice roofs. The mix of styles and ages of buildings within the area combines to create an aesthetically pleasing and diverse whole.
- 5.2.21 The Burtoft and Clifton Hampden pre-submission draft Neighbourhood Plan (Nov 2020) provides a short character assessment of the Clifton Hampden Conservation Area; identifying seven distinct character areas, namely Upper High Street, Lower High Street, A415 East, A415 West, Courtiers Green, Oxford Road and Watery Lane:
- The Upper and Lower High Street areas form the historic and functional core of the village. Upper High Street is a gently curving road going down the hill from the traffic lights to the bridge leading

across the river Thames. Its character is interesting with a number of features that are typical of a quaint village, including cottages, village shop/post office, primary school, river bank/wharf, roadside parking, boardwalk, all presided over by the local church looking down from the hilltop. There are attractive typical village cottages with lots of traditional features including wooden window frames (mostly partitioned) and thatched or tiled roofs with attractive brick-built chimneys. Behind the cottages lie the Old Vicarage and the Manor House, neither of which are easily in view but both of which are iconic characteristics of the village of Clifton Hampden.

- The Lower High Street winds its way westwards from a junction with Upper High Street just north of the bridge. It feels especially rural as a country lane with fields, horses, little traffic and is safe but dark. There are traditional, rural, farm buildings, cottages, thatch, old brick varying from one/two-bedroom cottages to 5 bedroom (or more) ex-farmhouses. Some are 300+ years old; some are barn conversions. The gaps between buildings are varied and based on conversion from historic use to cater for today's requirements. Some cottages are close together with limited space, especially in front, with little space for cars.
- From the traffic lights at the centre of Clifton Hampden, proceeding east along the very busy A415, the character of the village changes into open spaces comprising mostly farmland with a few buildings dotted about. There are three sets of buildings, one within the Recreation Ground on the north side of the A415, one comprising outlying buildings attached to the Manor and, further up the road, lies Croft Cottages. These cottages are more recently built but adhere to the traditional architecture, with panelled windows, wooden doors with glass panels, tiled roofs and brick chimneys.
- From the traffic lights proceeding west along the A415, there is a mixture of buildings, mostly large, and open spaces including the allotments. Past the developments there are open spaces on either side of the busy road up to the complex of petrol station, garage, forge and accommodation backing onto fields. Opposite the High St is the village pub (currently used as a B&B), which is an attractive white building with a thatch roof, originally built in the 17th century, still retaining low beam ceilings. Next door is a red brick thatched detached cottage and then the Village Hall, which has served the village for a number of years, and its car park. Opposite, across the busy A415, is the primary school, housed partly in a traditional building. Proceeding west there are three detached houses in substantial plots built in keeping with the village, panelled windows, tiled roofs, brick chimneys. They are all reasonably set back from the A415.
- Courtiers Green is a T-shaped cul-de-sac of uniform 1950s semi-detached, 3- or 4-bedroom houses that are separated by garages. Some have been extended above so no gap remains on the first storey. There is normally no access to the rear garden, except through the garage. There are small front garden grassed areas and concrete or paved driveways to each property. Windows are generally large PVC, including a very large front room window to a low window seat. All houses (except one), have original chimneys. A newer detached house stands at the entrance to Courtiers Green in sympathy with both Courtiers Green and the Oxford Road. This has a chimney and gravelled driveway. A grassed bridleway joins Courtiers Green to the driveways at the rear of some Oxford Road properties.
- There is a mix of style of houses along Oxford Road. The majority are Victorian semi-detached cottages set back from the road with a small front garden area, which have retained their character and contribute to the picturesque village. The fencing surrounding properties and along the edge of the footpath is split chestnut fencing. There is good spacing between the pairs of semi-detached properties, enough for parking adjacent to the property and in some cases garages. There is greenery and foliage in gardens and boundary hedges of beech, box and mixed hedgerow. There are a number of old and large trees, including Plane/Lime. In summer hollyhocks line the pavements. Set much further back from the road on the West side of the Oxford Road travelling out of the village are larger, detached houses and converted barns. On the east side of the road closest to the traffic lights are newer detached houses with paved driveways, fencing and walls of different character to the other dwellings on the Oxford Road. All have dormer windows, and some have hipped roofs. Extensions have been done in keeping with the style and character and retained key features. All dwellings have chimneys.
- Watery Lane is an eclectic and characterful mix of properties. It includes the early 18th century Courtiers House and adjoining cottages; 17th century thatched houses, having been converted from multiple dwelling into one; an original Coach House; and a 19th century house converted to a doctor's surgery. There are also a number of 20th century houses and bungalows on the west

side of the lane. The properties have large gardens on varying aspects. Properties on the east side are closer to the road and have larger front garden areas. There is also a series of small cottages attached to the back of Courtiers House at right angles. The buildings on the west side of the lane have large front garden areas and split chestnut fencing boundaries. Each property has its own style and is maintained in keeping with its era.

- 5.2.22 Keys views within the conservation area demonstrate the prominence of the Church of St Michael and All Angels [A185], situated on a rise above a bend in the river. This was probably the 'cliff' of the Old English placename 'Clifton'. The church's prominent siting dictates that it forms the backdrop to views along High Street; those looking south feature the church behind architecturally interesting buildings in the foreground; whilst views from the river feature the Church prominently in views towards the town. A key view is achieved from Clifton Hampden Bridge [A178], where the church is the largest of a very small number of buildings that are visible amongst the greenery on the opposite riverbank. The combination of the bridge parapet, the river and the church backed by mature vegetation gives an impressive view of the core of the conservation area on approach from the south-east.
- 5.2.23 The heritage value of the conservation area is drawn from its architectural and historical interest as an early-medieval settlement centred on a rise overlooking the river which was probably fordable at that time. The historical interest of the settlement lies in its linear plan form demonstrating how the village grew along two routeways leading from the river crossing. Further historic interest is provided by the area's individual buildings and their group value with each other. This also provides its architectural interest. The restored Manor House and Clifton Hampden Bridge were designed Sir George Gilbert Scott, and the Church of St Michael and All Angels was also altered by Scott, as part of wider improvements he made to village to create the vision of a picturesque idyll of buildings in the landscape. This is a key historical association for the conservation area. The area also has archaeological interest in its buildings dating from the medieval period and in its open spaces where there is the potential for discoveries relating to the village's early-medieval origins. The area is a pleasant rural village which gave rise to its featuring in the classic work *Three Men in a Boat (To Say Nothing of the Dog)*, a travel account-cum-novel written by Jerome K. Jerome in 1889. In it the settlement is described as 'a wonderfully pretty village, old-fashioned, peaceful, and dainty with flowers, the river scenery is rich and beautiful. If you stay the night on land at Clifton, you cannot do better than put up at the "Barley Mow".' That the settlement could be described in the same way today adds to the significance of the area and provides it with a degree of artistic interest.
- 5.2.24 The boundary of the conservation area includes the majority of the built form within the settlement, together with fields to rear of buildings lining its main thoroughfares. This defines its character as a contained rural settlement. The approaches to the conservation area have a rural character featuring tree-lined and hedge-lined roads, where open-aspect views are also a strong feature, across farmland that emphasises the rural setting of the conservation area. This contributes to the heritage value of the asset by enhancing understanding of its form as a rural settlement. Views from outside the settlement seldom feature any of its buildings, however from higher ground to the north of the settlement, between it and Nuneham Courtney Park and Garden, a view of the steeple of the Grade II* listed Church of St Michael and All Angels [A185] can be achieved where it is nestled in the mature trees along the river valley (Plate 19). Whilst this is distant and unlikely to have been a designed view, it demonstrates Gilbert's Scott's picturesque vision for the conservation area. The river is also a key feature running through the asset, and within its setting. From where views of some its key buildings can be achieved.



Plate 19. View south towards Clifton Hampden from land north of Coppice House, the arrow indicates the steeple of the Grade II* listed Church of St Michael and All Angels.

5.2.25 The village and conservation area provide the setting for the listed buildings within it. The conservation area contains 26 listed buildings, these are detailed in Table 5.2.

Table 5-2 Listed buildings in the Clifton Hampden Conservation Area.

Report Ref.	NHLE number	Name/Description	Type	Grade
A168	1059782	Lower Town Farmhouse and Attached Barn	Farmhouse and barn	II
A169	1059785	Granary 30m south of Lower Town Farmhouse	Granary	II
A170	1368836	Roubartelle Abbas	House	II
A171	1194412	The Orchard	House	II
A172	1059781	Little Place Cottage	Cottage	II
A173	1059780	Vine Cottage	Cottage	II
A174	1368835	Clematus Cottage	Cottage	II
A175	1059779	Bridge End Cottages at SU 5460 9545	Cottage	II
A176	1368834	Small Barn at SU 5462 9546	Barn	II
A177	1059818	Bridge End Cottages at SU 5463 9547	Cottage	II
A178	1059815	Clifton Hampden Bridge	Bridge	II*
A179	1368812	Bridge House	House	II
A180	1047903	The Barley Mow Tavern Public House	Public House	II

A181	1059783	Archway, Steps and Memorial Cross to the First Lord Aldenham 3m south of Church of St Michael and All Angels	Memorial	II
A182	1368815	Bridge End Cottage	Cottage	II
A183	1059817	Clifton Hampden Church of England Primary School and Attached Teachers House	School	II
A184	1368843	K6 Telephone Kiosk, High Street	Telephone kiosk	II
A185	1368837	Church of St Michael and All Angels	Church	II*
A186	1368813	Clifton Hampden Manor	House	II
A188	1194421	The Red House	House	II
A189	1285700	Mesopotamia Cottage	Cottage	II
A191	1194428	Garden Wall 10m southeast of Coutiers	Garden wall	II
A214	1059784	Lychgate 25m north east of Church of St Michael and All Angels	Gate	II
A216	1059816	The Plough Public House	Public House	II
A217	1059787	Courtiers	House	II
A218	1059786	Jamaica Cottage and Adjoining Cottage	Cottage	II

5.2.26 The significance of the listed buildings within the conservation area is drawn from their individual and collective historic and architectural interest as examples of vernacular building in the village, beginning in the 13th century with the Church of St Michael and All Angels. The buildings include farmhouses that illustrate the agricultural history of the area, as well as a series of cottages and polite houses demonstrating several periods of British architectural history and a range of materials and styles. The buildings designed, or altered, by Sir Gilbert Scott have an additional layer of associative historic interest and architectural interest. These include the Church of St Michael and All Angels **[A185]**, Clifton Hampden Bridge **[A178]** and the restored Clifton Hampden Manor **[A186]** which are located in proximity with one another, and which have group value through this architectural association and through patronage. Whilst it is not possible now, to view all three assets in combination, it is likely that this was a design intention when they were originally built/altered by Gilbert Scott, in views that also feature the river and its green banks. In terms of the settings of the listed buildings within the conservation area, these are generally inward looking and defined by the bounds of the settlement which is contained entirely within the conservation area boundary. The river also plays a key role in the setting of assets lining its banks and for Clifton Hampden Bridge. The exception to this is the Church of St Michael and All Angels **[A185]**, where a view of the steeple has been identified from the higher ground to the north of the conservation area, between it and Nuneham Courtney Park and Garden. Here the steeple of the church is visible nestled in the trees along the river valley in a fortuitously picturesque composition.

5.2.27 The Burcot and Clifton Hampden pre-submission draft Neighbourhood Plan (Nov 2020) also identifies a series of buildings as community assets within the conservation area. These buildings are listed in Table 5-3 below. buildings add to the character already established by the designated assets reflecting the area's development as a rural settlement. In the case of the Shop and Post Office **[A266]**, the asset features in foreground of a key view on High Street of the Church of St Michael and All Angels **[A185]** and therefore makes a positive contribution to the setting of that grade II* listed building.

Table 5-3 Non-designated buildings in the Clifton Hampden Conservation Area

Report Ref.	Ref number	Name/Description	Type
A266	-	The Shop and Post Office, High Street	Shop and Post Office
A267	-	The Surgery, Watery Lane	Surgery

▪ **Milton Conservation Area**

5.2.28 Milton Conservation Area [A220] contains 19 listed buildings, within the study area, including the Grade I listed Milton Manor Cottage and Milton Manor House [A3] and the Grade II* listed buildings at the Church of St Blaise [A4] and 42a and 42b High Street [A8]. The remaining assets are Grade II listed. It is a small rural village which has Saxon origins and which has evolved from medieval times alongside an important north/south trade route running between Abingdon, East Ilsley and Newbury. The settlement has the character and appearance of a rural village of the late-18th to early-19th century with buildings being mainly of red-brick construction with plain tile roofs and of predominantly single or two-storeys, with some larger buildings of two-storeys and an attic. The buildings display individual design, with several having checkerboard brick and other architectural embellishments. On High Street buildings generally face directly onto the main road, without front gardens, but moving northward along High Street and on School Lane and Old Moor, off High Street, small front gardens are more common, enclosed with brick or stone boundary walls. Several of the buildings have brick frontages that disguise or have entirely replaced older timber-frame construction, whilst exposed timber framing is present on a small minority of buildings, such as the Grade II* listed 42a and 42b High Street [A8]. The conservation area also includes fields to the north-west and south of the village centre. Those to the north-west contain remains of a medieval field system.

5.2.29 The Milton Conservation Area Appraisal (Vale of White House District Council 2016b) identifies six Character Areas within the village: The Mill; the medieval field system; the Manor and Church; High Street; School Lane; and farm groups. The Mill character area and listed building lies outside the study area for this assessment and as a separate character area, it can be omitted from consideration of the conservation area for the purposes of this assessment.

- The medieval field system character area is focused on the area north of the Mill Lane. The visible earthworks in its area demonstrate the medieval character of the settlement and are key features of the entrance into the village.
- The Manor and Church character area is focused on Milton Manor House, the Church of St Blaise and the Old Rectory. The buildings characterising this area are generally large detached, high status buildings with large gardens. The boundary walls to the three key buildings are a defining feature of the area, whilst the church is a landmark building seen in key views within the rest of the village and also from outside the settlement.
- The High Street character area is focused on the main north/south route through the village demonstrating its linear development. The density of buildings increases towards the central core at the crossroad to Milton Manor House and School Lane. Houses in this area have an 18th to 19th century appearance and are generally brick-built with limited garden space onto the road. Some relief from the built form is provided by open space on the west side of the road allowing views across former orchards.
- The School Lane character area was formerly an important east/west route within the village named after the 18th century brick-built school near the junction with High Street. In contrast to the High Street character area, this part of the conservation area contains a mix of tightly packed 18th and 19th century brick-built buildings interspersed with larger, individually designed building, some of which have earlier origins such as 6 School Lane (Old School House), 19 School Lane and Old Manor Cottage. Here some exposed timber framing and thatch is present.

- The Farm Group character area is at the end of School Lane where historically there were detached clusters of farm buildings within their farmland on the edge of the village. The former farmland has largely been built over, but the agricultural character of the historic buildings remains providing an illustration of the former connection of this village with the rural farmland setting around it as well as providing an understanding of the historic village limits.

5.2.30 Milton Conservation Area has archaeological interest in its buildings dating from the medieval period and in its open spaces where there is the potential for discoveries relating to the village's Saxon origins. The historical interest of the settlement lies in its linear plan form demonstrating how the village grew along this important routeway and related to the wool trade. This is further emphasised by the dedication of the church to St Blaise, the patron saint of wool combers. Further historic interest is provided by the area's individual buildings and their group value with each other. This also provides its architectural interest. The area is a pleasant rural village with architecture ranging from the polite, symmetrical form of the Manor and Old Rectory, through to the more irregular form of the vernacular farms, cottages and houses that date from medieval period onwards.

5.2.31 The village and conservation area provide the settings for the listed buildings within it. The conservation area contains 18 listed buildings, within the study area, these are detailed in Table 5.4.

Table 5-4 Listed buildings in the Milton Conservation Area within the Study Area

Report Ref.	NHLE number	Name/Description	Type	Grade
A10	1048181	Home Farm Cottage. A 17 th century timber-frame cottage with rendered infill and some later alterations.	Cottage	II
A11	1300911	Home Farmhouse. A 17 th century, red brick farmhouse with 18 th and 19 th century alterations and elements of roughcast render.	Farmhouse	II
A12	1368669	Old Moor Grange and Stepstone Cottage. A late- 17 th century, red brick farmhouse, now 2 dwellings.	Farmhouse	II
A3	1048220	Milton Manor Cottage and Milton Manor House. A manor house, built in c.1670, with attached kitchen and brewhouse range, part converted to dwelling.	Dwelling House	I
A2	1048221	Stables and Coach House approx. 60m NE of Milton Manor House. A red brick stable and coach house dated c.1764	Stable and Coach House	II
A227	1300938	Kitchen Garden Walls approx. 70m NE of Milton Manor House.	Garden Walls	II
A1	1368649	Sluicehead approx. 45m E of Milton Manor House. An ashlar stone sluicehead, probably by Stephen Wright, of c.1764.	Sluicehead	II
A4	1368648	Church of St Blaise. A Church with a 14 th century west tower and south porch; nave, north aisle, and a chancel of c.1849 by Henry Woodyer.	Church	II*
A5	1200074	Font approx. 25m SE Church of Blaise. A font comprising a 14 th century stone bowl on a 19 th century octagonal stone pillar.	Font	II

A17	1465013	87 High Street. A timber-framed cottage retaining later 16th century or 17th century elements with a brick frontage and a southern bay added in around 1900.	Cottage	II
A7	1368647	Tythe Barn Cottage. A 17 th -century, single-storey and an attic house with later alterations.	Cottage	II
A9	1200044/	The Old Bakery. An 18 th century stables, now a house, possibly incorporating earlier structure, with 20 th century alterations and rebuilding.	Converted Stables	II
A8	1300905	No. 42a and No. 42b High Street. An early-14 th century single-ended hall-house plan house, with 15 th century extensions and later alterations, now 2 dwellings.	Dwelling Houses	II*
A13	1048219	Lamplight House. A red brick double-depth plan house, dated 1780.	Dwelling House	II
A14	1368668	Mallams. House of c.1830 in colour-washed red brick.	Dwelling House	II
A15	1300909	Vine Cottage. An early-18 th century red brick house.	Cottage	II
A18	1200060	Milbrook House School House. Late-16 th century red brick farmhouse, encased with 18 th an 19 th century alterations, now a school.	Converted Farmhouse	II
A285	1048221	Stables and Coach House approximately 60m North East of Milton Manor House	Stable and coach house	II

5.2.32 The significance of the listed buildings within the conservation area is drawn from their historic and architectural interest as examples of six centuries of vernacular building in the village, beginning in the 14th century with the Church of St Blaise. In many cases this interest illustrates the agricultural history of the village, although most of its agricultural buildings have been converted to residential uses. The settings of the listed buildings are informed by their place within the settlement including the village's dispersed plan form and the large garden plots afforded to the dwellings. These contribute to the significance of the assets in demonstrating the development of the village and its economy from the medieval period onwards.

5.2.33 The Conservation Area Appraisal (Vale of White House District Council 2016b) also identifies a series of buildings of local interest within the conservation area. These buildings are listed in Table 5-5 below. They are generally located along High Street with a few exceptions. These buildings add to the character already established by the designated assets reflecting the area's development as a rural farming settlement.

Table 5-5 Non-designated buildings in the Milton Conservation Area within the Study Area

Report Ref.	Ref number	Name/Description	Type
A240	-	The Old Rectory with stables and outbuildings.	Rectory
A241	-	First World War Memorial.	Memorial
2422	-	2 Sutton Road (Stonemasons Cottage) & 10 Sutton Road.	Houses
A243	-	The Plum Pudding Public House (Formerly The Admiral Benbow).	Public House
A244	-	High Street Nos. 7 (Fern Cottage), 31 (Rose Cottage), 33 & 33a (Chestnut Cottage), 35 (New Inn), 49, 51 (The Old Post Office),	Houses

53, 57, 59, 62, 65, 66-68 (Monday Cottages), 69-70, 73, 75, 76-79, 81, 85, 87, 102, 104.

A245	-	1-7 Little Lane.	Houses
A246	-	Millbrook Barns and outbuildings incl. Granary, High Street.	Farmstead
A247	-	64-66 Pembroke Lane (Old Coach House) and 68 Pembroke Lane (Former Chapel).	Coach house and former Chapel.
A248	-	Mallams Court (formerly Cannons Yard), High Street.	House
A249	-	6 School Lane (The old School House) Old Milton Cottage, Milton Cottage and 18 School Lane	School House
A250	-	Barn 20m south east of Home Farm, School Lane	Barn
A251	-	Manor Farm, Old Moor	Farm

5.2.34 Significant views within the conservation area include those towards its landmark buildings such as the Grade I listed Milton Manor House, the Grade II* listed Church of St Blaise, and the Grade II listed Home Farm and Old Manor Farm. These views contribute to the setting and significance of these assets. More general views of the street scene also help to convey the character of the conservation area and its important asset groupings. Linear views along High Street, open and glimpsed views across the field systems and views to the greenery of surrounding gardens make a positive contribution.

5.2.35 The setting of the village is the Vale of Aylesbury. The village was historically an agricultural settlement with several fields containing medieval ridge and furrow surviving associated with the medieval manor house, its setting amongst the pastureland of the Vale contributes to its significance. Significant views outwards across open countryside are available to the north and northeast of the settlement, as well as to the east across open fields at the end of the byway from Old Moor. The surrounding landscape is low lying and flat with hedge and tree-lined field boundaries. The nearby settlements of Sutton Courtenay, Didcot and Steventon can be seen in views across the fields from the village. There are important views of the settlement from the west, particularly from the footpath leading from the bridge over the A34 across the meadows towards Milton. To the south of the settlement there is significant commercial development, between it and the railway, that is of out of character with the conservation area affecting understanding of the rural character of the settlement and harming the character of approaches to the settlement on that side.

▪ **Sutton Courtenay Conservation Area**

5.2.36 The northern end of Sutton Courtenay Conservation Area [A222] lies within the study area for this assessment. This area contains thirteen Grade II listed buildings as detailed in Table 5-6 below.

Table 5-6 Listed buildings in the Sutton Courtenay Conservation Area within the Study Area

Report Ref.	NHLE number	Name/Description	Type	Grade
A158	1194571	Sutton Bridge and causeways (that part in Culham Civil Parish)	Bridge	II
A159	1182464	Sutton Bridge and causeways	Bridge	II
A286	1052727	Courtenay Lodge	House	II
A268	1052730	The Wharf	House	II

A269	1052731	Wharf Cottage	House	II
A272	1182205	Little Chemscode	House	II
A273	1182296	Wharf Barn	Barn	II
A274	1182304	River Cottage	House	II
A276	1284624	Walton House	House	II
A277	1284657	20 and 22, Church Street	House	II
A279	1368066	The Almshouses and Attached Walls and Gate	Almshouse	II
A280	1368101	Mill House	Mill house	II
A281	1368102	Tudor Cottage	House	II

5.2.37 The conservation area as a whole contains a further 51 listed buildings and the Grade II Registered Park and Garden of Sutton Courtenay Manor [NHLE: 1001107] within its boundary. Three broad character areas can be observed within the conservation area boundary. The central part of the conservation area is focused on the historic village centre, which displays a dispersed and irregular plan form. Its core is the manor of Sutton Courtenay which has Saxon origins and surviving standing buildings with medieval and later fabric. These include assets designated at the highest levels such as the Grade I listed Norman Hall [NHLE: 1182314] The Abbey (a former rectory) [NHLE: 1052729] and the Church of All Saints [NLHE: 1182209] and the Grade II* listed Manor House [NHLE: 1052732] and its separately Grade II* listed outbuilding [NHLE: 1182341] and gatepiers [NHLE: 1052734; 1368103]. This core area is outside the study area for this assessment. Around these core buildings the post-medieval growth of the settlement can be seen stretching along the Church Street and several of the listed buildings in Table 5-6 are located in this area lining the northern end of the road. These mainly date from the 17th century onwards and several display elements of exposed timber framing and later brick infill and alterations. The southern part of the conservation area follows the north-south alignment of High Street and includes the more regular and more tightly placed buildings (although not 'tightly packed') and strong boundary walls lining the street as an important route south from the core medieval settlement, representing the growth of the village along the road. This area contains a large number of listed buildings, mostly listed at Grade II and the majority dated to the 17th century with later alterations. Some also have 15th and 16th century origins. The northern part of the conservation area is an open area beyond the north end of the core settlement on the banks and flood plain of the River Thames. This is the element of the conservation area that largely lies within the study area for this assessment. It provides the crossing over the River Thames, comprising an early-19th century stone rubble bridge of three arches with causeways to the north and south. The character of this part of the conservation area is distinct from the centre and south areas of the settlement. It contains the mature green leafy banks of the Thames and the surrounding flat green fields marking the edge of the settlement.

5.2.38 Sutton Courtenay Conservation Area has archaeological interest in its buildings dating from the medieval period and in its open spaces where there is the potential for discoveries relating to the village's Saxon origins onwards. The buildings also have architectural interest in their age and rarity and their group value with other and the spaces between them being a key part of the character of the conservation area. The area contains a large number buildings listed at the highest, Grade I and Grade II*, level reflecting their intrinsic importance. The grouping of such buildings adds to the significance of the conservation area as a whole. The historical interest of the settlement lies in its plan forms, that demonstrate the dispersed character of the medieval manor, church and core settlement, and then the linear plan form along High Street demonstrating how the village grew. The area is a large rural village with architecture that ranges from high status medieval buildings, much as the manor and church, through to

the 17th century and later individually designed vernacular farms, cottages and houses that line High Street.

5.2.39 The conservation area boundary covers the majority of the built form covering the core of the settlement, except at its north end, where it excludes the buildings lining the south side of Appleford Road and the east side of Abington Road, and the south end where it excludes the settlement expansion beyond High Street south along Harwell Road and west along Milton Road. The setting of the conservation area in these latter areas is therefore formed by additional buildings that do not generally reflect the character of the core area and, therefore, do not contribute to its significance. To the east and west of the conservation area there are agricultural fields which contribute to understanding of the rural settlement. At the north end of the conservation area the setting is formed by the River Thames and Culham Cut which provides understanding of the siting of the settlement to take advantage of river access. There are three main routes into the conservation; from the east via Appleford Road and the north via Abington Road, that link into the north end of the settlement; from the south along Harwell Road and Milton Road that give access onto High Street; and from the west via Drayton Road that leads to the junction between the central core of the settlement and the southern area along High Street. Development on several of these approaches results in a suburban character on approach to the conservation area particularly on Appleford Road, Harwell Road and Milton Road, that detracts from the conservation area. Drayton Road and Abington Road retain a rural character that contributes to the conservation area. No key views of the settlement from the surrounding landscape have been identified as part of this assessment, and the Church of All Saints does not feature prominently in the surrounding landscape.

5.2.40 The village and conservation area provide the setting for the listed buildings within it. Within the main area of the settlement the settings are inward looking and defined by the buildings' relationships with each other and the road as part of the streetscene and for some their relationship with the river to the west. Their settings do not generally extend outside the settlement. This differs at the very northern end of the conservation area where the assets of Sutton Bridge and Causeways [A157] are located. The listing for the Grade II listed bridge and causeways is cut in two on the parish boundary, and so the other part of the bridge, within Culham Parish has a separate listing [A158] and is 'outside' the conservation area. For the purposes of this assessment they are considered together. A further asset connected with Sutton Bridge is the Bridge over Culham Cut [A157], so it is considered here also, although also outside the conservation area. The three-arched Sutton Bridge was constructed in c.1807. of stone rubble with ashlar stone dressings. To the north and south sides of the bridge there are stone ashlar causeways of three arches. On the north side the causeway was extended in 1809 to meet Culham Cut and the Bridge over Culham Cut [A157]. Culham Cut was dug in 1809 by the Thames Navigation Commissioners to bypass the difficult stretch over the river north of Sutton Courtenay. It extends for 1.2km west of the bridge, where there is also a lock. The bridge has a single arch of coursed stone rubble and low stone parapets. The two bridges and causeways are all interconnected and form an asset grouping with the non-designated lock. A toll house was also originally located adjacent to Sutton Bridge [A130], but this is no longer extant. The assets contribute to each other's settings and have key setting relationships with Abington Road that runs over them, the river and Culham Cut. They form an attractive rural approach to Sutton Courtenay Conservation Area contributing to its character and appearance.

▪ **Culham Conservation Area –**

5.2.41 Part of the eastern extent of Culham Conservation Area [A223] lies within the study area for this assessment. This area contains three listed buildings, Culham Court [A156], Culham House [A275], and 36 and 37 high street [A271], however, the conservation area as a whole contains eight listed buildings and one scheduled monument. This small conservation area is focused on the Grade II* listed Culham Manor [NHLE 1285637], a former 15th century monastic grange, and its adjacent hamlet which has its origins in the 9th century. The character now is of a 18th/19th rural settlement featuring large properties, irregularly planned and set back from the roads with large garden plots with mature trees. Long stretches of well-maintained brick and stone estate boundary walls and garden walls are a key feature moving through the area, these enclose and define the setting of most of its listed buildings. The tightly packed, regular development of houses along the south side of High Street are excluded from the conservation area. The building stock of is of a mixed character, featuring some large

Victorian brick-built semi-detached homes, rendered and part timber-framed historic farmsteads, and elite architecture such as Culham Manor and Culham House [A275].

5.2.42 The significance of the conservation area is drawn from its architectural and archaeological interests as an example of a small irregularly planned, dispersed settlement grown out of a medieval hamlet and former medieval grange. Although the area now has the character of a 18th or 19th century settlement its open areas, of which there are many within the gardens and paddocks within the designated area, retain archaeological interest in the evidence of medieval settlement that they may contain. The area has historic interest in its origins as a late-medieval grange associated with Abingdon Abbey.

5.2.43 To the south side of High Street and to the east of the conservation area at The Glebe and on Tollgate Road, there are residential buildings of planned suburban character that are out of character with the conservation area and affect the character of approaches to it, and views moving through it. Aside from that, the conservation area is surrounded by fields on all sides, contributing to understanding of the area as a small rural hamlet.

▪ **Nuneham Courtenay Conservation Area –**

5.2.44 Nuneham Courtenay Conservation Area [A225] covers much of the same area Courtney Registered Park and Garden [A207], however there two notable difference in extent. The conservation area is smaller than the park at its south and south-western extent, where the park includes Furze Brake, but the conservation area excludes it. The conservation area is also larger than the park at its north-east side, where the conservation extends to include the re-established, planned village of Nuneham Courtenay. The village contains 25 listed buildings (see Table 5-7), all at grade II and dating to the establishment of the village in the 18th century when it was moved from within the park. The building line the road and face each other on opposing sides. The character and values of the conservation area are the same as those described previously for the park, with the added interest of the village and its architectural and historic interest. A greater buffer area of non-developed land is present between the conservation area boundary and Culham Science Centre, than is the case for the park, owing to its smaller extent at Furze Brake.

Table 5-7 Additional listed buildings in Nuneham Courtenay Conservation Area.

Report Ref.	NHLE number	Name/Description	Type	Grade
Outside study area	1048037	32 and 33, A423	Cottages	II
Outside study area	1368710	Brewers of Nuneham Limited	Former blacksmith's house and forge	II
Outside study area	1368713	34 and 35, A423	Cottages	II
Outside study area	1048034	23 and 24, A423	Cottages	II
Outside study area	1368714	Stable Block approx. 10m South of the Harcourt Arms Inn	Stable	II
Outside study area	1193363	The Harcourt Arms Inn	Public House	II
Outside study area	1048040	13 and 14, A423	Cottages	II
Outside study area	1048043	5 and 6, A423	Cottages	II
Outside study area	1286200	36 and 37, A423	Cottages	II
Outside study area	1368711	25 and 26, A423	Cottages	II

Outside study area	1048035	27 and 28, A423	Cottages	II
Outside study area	1048044	1 and 2, A423	Cottages	II
Outside study area	1048033	21 and 22, A423	Cottages	II
Outside study area	1048038	38, 39 and 40, A423	House	II
Outside study area	1048041	11 and 12, A423	Cottages	II
Outside study area	1193400	3 and 4, A423	Cottages	II
Outside study area	1193386	15 and 16, A423	Cottages	II
Outside study area	1048042	7 and 8, A423	Cottages	II
Outside study area	1048039	17 and 18, A423	Cottages	II
Outside study area	1048004	K6 Telephone Kiosk Outside the Post Office	Telephone kiosk	II
Outside study area	1368712	29 and 30, A423	Cottages	II
Outside study area	1286210	19 and 20, A423	Cottages	II
Outside study area	1193395	9 and 10, A423	Cottages	II
Outside study area	1193390	The Old School House	School House	II
Outside study area	1048036	Number 30a (Post Office) and Number 31	Post Office	II

▪ **Didcot (Old) Conservation Area**

5.2.45 Didcot (Old) Conservation Area **[A221]** lies within the study area for this assessment. This area contains twelve listed buildings within the study area as detailed in Table 5-8 below, these include the Grade II* listed Church of All Saints **[A235]**, the remainder being Grade II listed.

Table 5-8 Listed buildings in the Sutton Courtenay Conservation Area within the Study Area

Report Ref.	NHLE number	Name/Description	Type	Grade
A233	1047916	Smiths Farmhouse and Attached Walls	Farmhouse	II
A234	1047917	Blagrove Farmhouse	Farmhouse	II
A235	1047918	Church of All Saints	Church	II*
A236	1047919	Cross approximately 4m South of Church of All Saints	Cross	II
A237	1047920	Group of 4 Headstones and one Coffin Slab 1m South and East of South Aisle of Church of All Saints	Memorials	II
A238	1047921	Church Roomsrectory Cottages	House	II
A239	1047922	The Nook	House	II

A284	1047923	29 and 31, Manor Road	House	II
A271	1180791	Thorney Downe Cottagethorney Downe House	House and Cottage	II
A278	1285283	Manor Cottage	House	II
A282	1368767	White Cottage	House	II
A283	1368805	125, Lydalls Road	House	II

5.2.46 This small conservation area is focused on historic core of the settlements of Didcot which has expanded far beyond its historic extents. The oldest surviving building within the area is the Church of All Saints **[A235]** which has 12th century origins and sits within its churchyard as a key feature of the conservation area. The remaining buildings are generally small residential properties focused in the area of Manor Road, Lydalls Road and Foxhall Road. These buildings generally date from the 17th century onwards, but they are likely to be replacements of medieval buildings forming the settlement associated with the church. The buildings have a mixed palette of material features exposed timber framing, render and brick to buildings with attractive stone boundary walls also featuring. The present character is largely 18th century, but it is evocative of the area's earlier origins. The presence of two farmhouses on the outer edges of the conservation area **[A233 and A234]** hints at the area's former rural character and demonstrates the former extent of the original hamlet. These farmhouses therefore have an important role in demonstrating the area's history, although Blagrove Farmhouse **[A234]** has lost its farm buildings and is therefore understood now as simply a house.

5.2.47 The significance of the conservation area is drawn from its architectural and archaeological interests as an example of a small irregularly planned hamlet where the medieval origins of the settlement can be understood, even when its buildings are generally later. Although the area now has the character of a 18th or 19th century settlement its open areas, of which there are many within the gardens and paddocks within the designated area, retain archaeological interest in the evidence of medieval settlement that they may contain.

5.2.48 The conservation area is surrounded on all sides by modern housing and commercial development, some of which encroaches into the area to detracts from its significance. The setting does not make a contribution to the conservation area.

5.2.49 The conservation area contains and provides the setting for the listed buildings within it which are arranged along its streets. The buildings vary in style and materials, and in their relationships to the roads in terms of alignments and the presence or absence of gardens and boundary features. This created an aesthetically pleasing and coherent character for the area as well as providing a setting for the buildings that contributes to their significance. The churchyard, with its upstanding memorials, some of which are Grade II listed **[A236 and A237]** forms the setting for the Church of All Saints **[A235]** which is also informed by the concentration of historic buildings around it that reflect its history and purpose.

Listed Buildings outside the Conservation Areas

5.2.50 Outside the conservation areas described above, a notable collection of listed buildings is present in the settlement of Appleford, which is not a conservation area. There are also a number of listed buildings associated with the Great Western Railway, such as the Grade II listed Railway Transfer Shed and Engine Shed **[A65]** and **[A66]**, to the south of Didcot railway station, and the Grade II* listed Culham Station, Ticket Office and Waiting Room **[A209]** and its associated Grade II listed Overbridge and Thame Lane Bridge **[A160 and A212]**, east of Culham. Aside from those, further isolated listed buildings are located at the Grade II listed Fullamoor Farmhouse **[A161]** and the Grade II listed Schola Europea **[A155]**, the former Diocesan training college north-east of Culham.

▪ Assets within the settlement of Appleford

5.2.51 There are nine grade II listed buildings within the settlement of Appleford. These are detailed in Table 5.9. The listed buildings are grouped around Manor Farm [A146], an early post-medieval farmhouse that was probably built over a medieval predecessor, forming the centre point of the historic settlement adjacent to the Church St Peter and St Paul [A80], which has medieval origins. The cluster of listed buildings comprise the farmhouse and associated barns [A146 and A88], shelter shed [A79], farm workers cottages [A85] and boundary walls [A84]. Other listings include further village cottages, such as the large timber-framed thatched cottage of the 17th century [A82], on Church Road, and the 17th century, stone-built, Elm Hayes [A78] at the south end of the settlement. The listings demonstrate that the historic core of the settlement was to the east, with later expansion of the settlement moving westward towards the railway line.

Table 5-9 Listed buildings with Appleford

Report Ref.	NHLE number	Name/Description	Type	Grade
A85	1052769	Manor Farm Cottages	Cottages	II
A87	1052770	Holywell Cottage	Cottage	II
A88	1368085	The Tythe Barn and Eyston Barn	Barn	II
A84	1052767	Cob Wall approximately 5m south of Manor Farmhouse	Wall	II
A78	1368046	Elm Hayes	House	II
A146	1368083	Manor Farmhouse and attached Brewhouse Range	Farmhouse	II
A82	1052768	The Thatched Cottage and Attached Cob Wall	Cottage	II
A80	1052766	Church of St Peter and St Paul	Church	II
A79	1368084	Shelter shed approximately 40m east south east of Manor Farmhouse	Shelter shed	II

5.2.52 The cluster of listed buildings within the settlement have architectural and historic interest, as well as group value with each other. Their setting is formed by the extents of the historic settlement and the buildings are inward looking within the settlement and along Church Street and its back lanes. No key views out of the settlement, or into the settlement featuring key views of its buildings have been identified as part of this assessment. The expansion of the settlement westwards from its historic core contributes to understanding of its historic development, but it does not readily contribute to the setting and significance of individual assets. The expansion is characterised by a mix of non-designated late-19th and early-20th century historic buildings of some heritage value and mid-20th century development. Infill development of a suburban semi-detached character has also occurred along Church Street in between the listed buildings forming the historic core of the settlement. These erode the historic integrity of the asset grouping and detract from the setting and significance of the historic buildings.

▪ **Great Western Railway (GWR) Assets**

5.2.53 The designated assets associated with the GWR can be assessed as two groups; one group located south of Didcot Railway Station at the GWR Heritage Centre, and one group located at Culham Station. The Railway Transfer Shed [A66] and Engine Shed [A65] at the GWR Heritage Centre forms part of the collection of the GWR Society; a body formed in 1962 with the aim of preserving artefacts associated with the GWR Company. They are grade II listed buildings located approximately 980m south-east of the Site. The Engine Shed [A65] is a 1930s utilitarian building constructed in brown brick, asbestos sheet and metal. It was offered to the society for use a store after it was closed by British Rail in 1965, and the heritage centre

was formed. Subsequent to that the Railway Transfer Shed **[A66]**, a much earlier building designed by Brunel, was moved to its present location adjacent to the engine shed in 1983 as part of the society's growing collection. The Railway Transfer Shed formed part of Isambard Kingdom Brunel's series of buildings on the line, for which he is most famous. Brunel is an internationally renowned railway engineer who formed a large part of the establishment of Britain's early rail network. The significance of this building and this historic association can be recognised in the efforts made by the society to preserve it by moving it to its present location, and by its central place as part of the heritage centre. The base of the building is of 20th century engineering brick and the superstructure is timber-framing with weatherboarding and a corrugated iron roof with ventilator to the ridge. Two train arches present in each end with a lower arch to the centre. The setting of the Railway Transfer Shed has obviously changed through its relocation, but its present location adjacent to the Engine Shed and within a railway heritage centre contributes to understanding of the building and its heritage significance. Likewise, for the Engine Shed. The appreciation of both buildings and their interpretation and presentation by the society forms a key part of their setting, as does the various historic railway structures, locomotives and lines within the heritage centre around the buildings. The buildings are located within an areas of former railway sidings and there are lines to both their east and west sides which define the extent of their settings.

- 5.2.54 The second group of GWR buildings are still in active use at Culham Station Ticket Office and Waiting Room **[A209]**, which is a grade II* listed building, and the Overbridge **[A160]** and Thame Lane Bridge **[A212]** which are grade II listed. The Road bridge over the railway track at Appleford Station **[A91]**, to the west of Appleford settlement can also be included in this group. These assets are located to the north of Abingdon Road between Clifton Hampden and Culham. The station is closest to Clifton Hampden, but it is in Culham parish and the GWR therefore called it Culham. It formed part of an extension to the GWR in 1844 from Didcot to Oxford. The station and overbridge **[A209]** and **[A160]** are located approximately 30m north-west of the Site, whilst the Thame Lane Bridge **[A212]** is approximately 820m to the north. The station building **[A209]** was designed by Brunel and constructed in red brick on a stone plinth with ashlar stone dressings in a Tudor revival style. The building is rare survival of a Brunel-designed station, and it is the only surviving example of a station built to this particular design. This provides the asset with associative historical interest and architectural interest. These are enhanced by the survival of Brunel's original design drawing of the station. The Overbridge **[A160]** is a Brunel-designed, brick-built, elliptical-arched overbridge which carried the Dorchester-on-Thames to Abingdon road over the Didcot Junction to Oxford GWR Branch line. It has group value with the adjacent and contemporary Culham station building **[A209]**, with Appleford Station overbridge **[A91]** on the line to the south, which is contemporary with it and also designed by Brunel of similar style, and with Thame Lane Bridge **[A212]**, also designed by Brunel, as a brick-built flying segmental arch road bridge designed by Brunel. These structures form a key collection of Brunel-designed building and structures on the branch line, each with historical and architectural interest, as well as group value with one another. The setting of the structures is informed by their relationship with the active railway line and with each other. This setting contributes to the assets' heritage values.

▪ **Isolated Buildings**

- 5.2.55 Fullamoor Farmhouse **[A161]** is a grade II listed farmhouse located approximately 70m south of the Site. The farmhouse's significance is drawn from its architectural and historical interest, as a good example of 17th and 18th century vernacular domestic architecture. The building has two main ranges forming an L-shaped plan, and various outshuts and additions have been built on the north and east sides. The first phase of the building appears to be a c.17th century range orientated north-south, and which meets an 18th century east-west range at the south-east corner. There is a Victorian addition at the junction of the two, along with several later outshuts. The farmhouse is set within a courtyard and garden. Agricultural ranges that were present to the north of the farmhouse on 19th century OS maps have been demolished. The garden is surrounded on the east, south and west sides by farmland. To the north the farm's drive meets Abingdon Road which runs east-west and to the north of the road the landscape takes on the character of a suburban park at the entrance to Culham Science Centre. The land to the north was originally part of the farm's landholding but it has since been developed, first for Culham Airfield in the Second World War, and then as the Culham Science Centre. The agricultural landscape around the east, west and south sides of the farmhouse is part of the historical landholding associated with Fullamoor Farm and it enhances appreciation of the building's historic use as a farmhouse, although this has been eroded by the loss of the

agricultural buildings. The land to the north of the farm makes a very small contribution to the through providing the historic route of access to the asset and through having an overall green character formed by the landscaping for Culham Science Centre. It no longer reads as farmland associated with the farm.

- 5.2.56 Schola Europea [A155] is the grade II listed building, north-west of Culham, approximately 320m west of the Site. It derives its heritage value from its historic and architectural interest as a former Diocesan training college built in c.1851 by Joseph Clarke. Clarke was known for school building and published a book on the subject, *Schools and Schoolhouses: a series of Views, Plans, and Details, for Rural Parishes*, in 1852. This building fits firmly within his established specialism and therefore this association between the building and the architect forms part of the asset's historic interest. The building is stone-built with an old plain-tile complex roof. It is arranged as a U-shaped courtyard plan with an attached chapel in High Victorian Gothic style. It has been altered with 20th century additions with 1960s work by Seely and Paget, one of the most noteworthy architectural partnerships of the inter-war period. This project would have been one of their last, prior to Seely's death in 1963. Later additions to, and around, the building complex have included a series of detached ranges to the north of the main building and the creation of a new entrance and coach park on that side. Semi-detached houses have also been added along Thame Lane to its west side, in an area shown as a possible kitchen garden on 19th century OS maps. The building sits between Thame Lane and Abingdon road, and it is set back within this large plot, bounded by mature trees and boundary fences of various designs. The setting is therefore enclosed and views out from the building, or into it from the surrounding landscape are not a feature of its setting. The contribution of setting to the significance of the asset is limited to its immediate surroundings representing the extent of its grounds.

Assessment of Potential Impacts to Designated Assets

- 5.2.57 The site visit and the assessment of significance and setting outlined in the previous section allows for consideration of the potential for the Scheme to result in significant effects to designated assets through change to their settings. It also allows for the identification of assets where there is no potential for the Scheme to result in such effects. Such assets can now be scoped out of further assessment. Table 5.10 provides a summary of these assets and the rationale for scoping them out of further assessment.

Table 5-10: Designated assets scoped out of further assessment

Asset ID	Designation and Grade	Name	Rationale for scoping out of assessment
A25, A26 and A28	Scheduled Monument	Settlement site SM1004853	The monument is located some distance from the Site, separated by the Milton Park development, railway line and the A4130. This asset and its setting are not expected to be impacted by the Scheme.
A76	Scheduled Monument	Settlement site SE of Church SM1004849	The monument is located some distance from the Site, separated by the railway line and main road. This asset and its setting are not expected to be impacted by the Scheme.
A109	Scheduled Monument	Round barrow cemetery at Fullamoor Plantation SM1421606	The monument is located some distance from the Site, separated by the railway line and Abingdon Road. This asset and its setting are not expected to be impacted by the Scheme.
A219	Scheduled Monument	Settlement site at Northfield Farm SM1002925	The monument is located some distance from the Site, separated by Clifton Hampden, the River Thames and the A415. This asset and its setting are not expected to be impacted by the Scheme.
A220	Conservation Area and the	Milton	The Site does not form part of the setting of the conservation area or the listed buildings it contains.

and assets in Tables 5-4 and 5-5	listed buildings and non-designated buildings therein.		The conservation area is focused on the historic core of the settlement and views outward over the surrounding fields to the north and west. There is sufficient distance and significant intervening development between the conservation area and Site, which is located south-west of the asset. The Zone of Theoretical Visibility (ZTV) (see ES Chapter 8: Landscape Figure 8.3) demonstrates that the conservation area has no inter-visibility with the Site and it is not considered that there will be significant changes in traffic levels within the conservation area during construction or operation as a result of the Scheme (see ES Chapter 16).
A222 and assets in Table 5-6	Conservation Area and the listed buildings therein	Sutton Courtenay	The Site does not form part of the setting of the conservation area or the listed buildings it contains. The conservation area is focused on the historic settlement and the area to the north up to the river. The key views are inward looking along its historic streets. The ZTV (see ES Chapter 8: Landscape Figure 8.3) demonstrates that within the study area the conservation area has no inter-visibility with the Site and this is based on a ZTV that does not include the screening effects of buildings which would further limit the visibility of the Site. The Noise assessment concludes that there will not be significant increases in noise levels through this area due to construction traffic (See ES Chapter 10). The Transport assessment (see ES Chapter 16) reports a predicted 30-40% reduction in traffic through the conservation area during operation, which is not EIA significant. The perception of this change in the conservation area and in the setting of its heritage assets is considered to be of negligible benefit . One the conservation area, of medium value , and the assets, generally of high value , this results in a slight beneficial significance of effect, which is not EIA significant.
A223 and assets A156, A270 and A271	Conservation Area and the listed buildings therein	Culham	The Site does not form part of the setting of the conservation area or the listed buildings it contains. The conservation area is focused on the historic core of the settlement. The key views are inward looking along its historic streets. There is sufficient distance and intervening built form between the conservation area and the Site and the ZTV (see ES Chapter 8: Landscape Figure 8.3) demonstrates that the conservation area has no inter-visibility with the Site. The Noise assessment concludes that there will not be significant increases in noise levels through this area due to construction traffic (See ES Chapter 10). The Transport assessment (see ES Chapter 16) reports a predicted 20-40% reduction in traffic through the conservation area during operation, which is not EIA significant. The perception of this change in the conservation area and in the setting of its heritage assets is considered to be of negligible benefit . One the conservation area, of medium value , and the assets, generally of high value , this results in a slight beneficial significance of effect, which is not EIA significant.
A221	Conservation Area and the	Didcot (Old)	The Site does not form part of the setting of the conservation area or the listed buildings it contains.

and assets in Table 5-8	listed buildings therein		<p>The conservation area is focused on the historic core of the hamlet which is now surrounded on all sides by housing and commercial development. The key views are inward looking along its historic streets. There is sufficient distance and intervening built form between the conservation area and the Site and the ZTV (see ES Chapter 8: Landscape Figure 8.3) demonstrates that the conservation area has no inter-visibility with the Site and this is based on a ZTV that does not include the screening effects of buildings which would further limit the visibility of the Site.</p> <p>It is not considered that there will be significant changes in traffic levels within the conservation area during construction or operation as a result of the Scheme (see ES Chapter 16).</p>
A155	Listed building grade II	Schola Europea	<p>The Site does not form part of the asset's setting. There is a meaningful gap between the Site and the asset and the scale of the interventions proposed in the vicinity of the asset are not considered likely to result impact to the asset's significance. The ZTV (see ES Chapter 8: Landscape Figure 8.3) demonstrates that within the study the conservation area has no inter-visibility with the Site.</p>
Assets in Table 5-9	Listed buildings within Appleford	Appleford - Various	<p>The Site does not form part of the setting of the listed buildings within Appleford which are focused in the historic core of the settlement at its east end away from the Site. There is sufficient distance and intervening built form between the Site and the listed buildings. The ZTV (see ES Chapter 8: Landscape Figure 8.3) demonstrates that there is no inter-visibility with the Site and this is based on a ZTV that does not include the screening effects of buildings which would further limit the visibility of the Site.</p> <p>The Noise assessment concludes that there will not be significant increases in noise levels through this area due to construction traffic (See ES Chapter 10).</p> <p>The Transport assessment (see ES Chapter 16) reports a predicted 30-40% reduction in traffic running north-south through the conservation area during operation, which is not EIA significant. The majority of assets within the settlement are located on the main east-west route through the settlement, so this change in traffic volume would not affect the settings of these assets. Only the grade II listed Elm Hayes [A78] on Main Road, is located on the main north-south route through the village. As a 17th century cottage aligned gable-end to the road this reduction is unlikely to be a considerable change to the asset's setting, but it may result in some heritage benefit through better understanding of the asset as a rural vernacular cottage. The perception of this change in the setting of Elm Hayes is considered to be of negligible benefit to this asset of high value, resulting in a slight beneficial significance of effect, which is not EIA significant.</p>
A91	Listed building grade II	Road bridge over railway track (at Appleford)	<p>The Site does not form part of the asset's setting. As a historic road bridge associated with the GWR the setting of this asset is assessed as its relationship with Appleford road, the railway and other listed bridges and structures along it. The ZTV (see ES Chapter 8:</p>

			Landscape Figure 8.3) demonstrates that there is no inter-visibility with the Site. The Scheme will have no impact upon the significance of the asset.
A212	Listed building grade II	Thame Lane Bridge	The Site does not form part of the asset's setting. As a historic road bridge associated with the GWR the setting of this asset is assessed as its relationship with Thame Lane, the railway and other listed bridges and structures along it. The ZTV (see ES Chapter 8: Landscape Figure 8.3) demonstrates that there is no inter-visibility with the Site. The Scheme will have no impact upon the significance of the asset.
A66	Listed building grade II	Engine Shed	The Site does not form part of the asset's setting. There is significant intervening development between the asset and the Site and the ZTV (see ES Chapter 8: Landscape Figure 8.3) demonstrates that there is no inter-visibility with the Site and this is based on a ZTV that does not include the screening effects of buildings and structure nearby which would further limit the visibility of the Site.
A65	Listed building grade II	Railway Transfer Shed	The Site does not form part of the asset's setting. There is significant intervening development between the asset and the Site and the ZTV (see ES Chapter 8: Landscape Figure 8.3) demonstrates that there is no inter-visibility with the Site and this is based on a ZTV that does not include the screening effects of buildings and structure nearby which would further limit the visibility of the Site.

5.2.58 The remaining assets are those where the assessment or consultation with stakeholders has identified the potential for the Scheme to result in impacts to the assets, or concern that the asset should be included and assessed in the Cultural Heritage Environmental Statement Chapter. The rationale for scoping in these assets is provided below, but the assessment of impact is provided in the Cultural Heritage Environmental Statement Chapter (ES).

5.2.59 Nuneham Courtenay Grade I **[A207]** Registered Park and Garden, Conservation Area **[A225]** and the listed buildings therein (see Tables 5-1 and 5-7) have been scoped into the ES due to the high degree of significance of the assets and due to the designed nature of the asset which makes it more sensitive to changes which may alter the design intention or the appreciation of it. The Site is outside the confines of the park and garden and the conservation area so the potential for impact will derive from changes to the assets' settings during construction and operation, including, for example, the physical presence of the Scheme, noise, lighting, alteration to traffic volumes and alteration to existing patterns of movement.

5.2.60 Clifton Hampden Conservation Area **[A224]** and the listed buildings and non-designated buildings therein (see Table 5-2 and 5-3) have been scoped into the ES due to the scale and nature of the Scheme in the vicinity of the asset. The Site is outside the confines of the conservation area so the potential for impact will derive from changes to the asset's setting during construction and operation. This includes elements such as the alteration to the northern approach into the conservation area and associated landscaping works, the physical presence of the Scheme, noise, lighting, alteration to traffic volumes and alteration to existing patterns of movement.

5.2.61 Culham Station and Ticket Office **[A209]** grade II* listed building and the station Overbridge **[A160]** grade II listed building have been scoped into the ES due to the high degree of significance of the assets and due to the nature of the works in proximity to the asset. The assets are located outside the Site so the potential for impact will derive from changes to the assets' settings during construction and operation, including, for example, the physical presence of the Scheme, tree clearance, noise and lighting.

5.2.62 Fullamoor Farmhouse [A161] grade II listed building has been scoped into the ES due to the scale and nature of the Scheme in the vicinity of the asset. The potential for impact will derive from changes to the asset's setting during construction and operation. This includes elements such as the introduction of a new roundabout, the realignment of the A415 and associated landscaping works, the physical presence of the Scheme, noise, lighting, alteration to traffic volumes and alteration to existing patterns of movement.

5.3 Non-designated Heritage Assets

5.3.1 There are currently 11 known non-designated, below ground, heritage assets within the Site. Of these, six assets are no longer extant; these are shown in Table 5-11: Five are extant, these are listed in Table 5-12.

Table 5-11 Non-Designated Assets, no longer extant

Report Ref.	HER reference	Name/Description	Type	Period
A70	PRN29115	Cropmark evidence of rectilinear enclosure within internal features and linear features.	Linear feature, rectilinear enclosure, pit?	Mesolithic, Neolithic, Bronze Age, Roman
A71	PRN29116	Cropmark evidence of probable trackway and rectilinear enclosures.	Linear feature, rectilinear enclosure, trackway	Mesolithic, Neolithic, Bronze Age, Roman
A93	PRN1885	Bronze Age beaker burial. Part of a vessel was found with an inhumation in c.1862.	Burial	Bronze Age
A101	PRN8481	Late Bronze Age to Saxon occupation at Appleford. Site covers an area of 20ha, showing evidence of occupation from Iron Age to Roman periods. Excavation has revealed Late Bronze Age pits; sequence of Mid Iron Age enclosures with trackway and possible field boundaries; Roman ditched trackway; enclosure system; waterholes; and a Late Roman or Saxon inhumation cemetery.	Pit, structure, boundary ditch, enclosure, pit, trackway, inhumation cemetery	Mesolithic, Neolithic, Bronze Age, Iron Age, Roman, early Medieval.
A108	PRN2852	Neolithic to Roman activity and settlement. Excavations found Neolithic to Roman funerary and agricultural activity. The cropmark here had originally been interpreted as a possible Roman villa.	Crouched inhumation, cremation, farmstead, ?villa	Neolithic, Bronze Age, Iron Age, Roman
A193	PRN1892	Anglo Saxon inhumation burials. 'Several human skeletons found with battle axes, swords and other similar articles of iron' found in c.1865 during drainage works	Findspot, inhumation	Early medieval

Table 5-12 Non-Designated Assets with the Site

Report Ref.	HER reference	Name/Description	Type	Period
A54	PRN28911	Prehistoric activity and Iron Age/Roman and Saxon settlements. 292 trench evaluation identified activity from Palaeolithic to post-	Ditch, double-ditched enclosure, field	Iron Age, Roman, early

		medieval periods, including: 3 Iron Age and Roman settlement foci; probably early medieval sunken feature building; and medieval and/or post-medieval/modern ridge and furrow cultivation, field drains and ditches	system, pit, posthole, ring ditch, grubenhaus, ridge and furrow	medieval, medieval, post-medieval, modern
A60	PRN27496	Middle Iron Age and Roman settlement at Great Western Park. Middle Iron Age settlement covers an area c.10 hectares and includes roundhouses, enclosures, c.600 pits and large droveway.	Pit, Post built structure, roundhouse, settlement, trackway	Iron Age, Roman (400BC to 409AD)
A36	PRN2838	Undated farmstead complex (probable Later Prehistoric to Roman date). Possible cropmark evidence of a farmstead complex of features, although there are indications that they are geological in origin.	Ditch, pit, rectangular enclosure, trackway	Unknown date (?later Prehistoric to Roman)
A142	PRN15315	Cropmark evidence of a possible un-dated enclosure	Enclosure?	Unknown
A163	PRN5641	Undated enclosures and pits. Cropmark evidence of enclosures and pits, indicating possible settlement.	Enclosure, pit	Unknown date

5.3.2 An analysis of historic maps pertaining to the Site and study area, combined with the site walkover and setting assessment, has identified one non-designated building within the Site and 13 non-designated buildings within the study area. In contrast to the designated listed buildings, the non-designated buildings identified are generally isolated buildings outwith the area's settlement foci. A number of isolated farms are recorded, and this is an asset type that does not feature as strongly in the area's designated assets.

5.3.3 Hill Farm **[A253]** is a non-designated asset located within the Site boundary to the south of Appleford. The farm is not mapped on the Appleford Tithe map of 1839, but a farm labelled as Hill Farm appears on the first edition 6" OS map dated 1883. The present buildings, however, relate to the farmstead as shown on the OS map of 1900 which captured the farm after redevelopment of the previous buildings shown on the earlier map. The OS map of 1900 shows a loose courtyard farm with the farmhouse located across the lane to the west of the farmstead. The buildings that survive of this farmstead are two parallel linear ranges arranged east-west, with a short north-south aligned range between. The farmhouse and other parts of the farmstead have been demolished. The northernmost building range is of two-storeys in blackened timber weatherboarding with a replacement hipped roof of cement boards. There is a projecting full height entrance bay to the north elevation. The other building ranges are single storey (possibly rebuilt) in brick with replacements roofs of corrugated metal and tile. The southernmost range is a stable with openings in its northern elevation facing into the farmyard. The farmstead buildings appear to be in use as part of an aggregate haulage business and no longer used for farming. The buildings derive their heritage value from their historic and architectural interest as examples of late-19th vernacular farm buildings. Their value is lessened by later alterations to the buildings and the loss of parts of the farmstead and the farmhouse. The setting of the buildings is dominated by the current use of the farmyard for the aggregate storage and transportation and the farmland to the west and north of the building has been subject to abstraction. The setting of the asset does not therefore make a continuation to its significance. As the asset is located within the Site and therefore in close proximity to the Scheme, the asset has the potential to undergo change to its setting as a result of the Scheme and it will therefore be assessed in the ES.

5.3.4 New Farm **[A252]** is a non-designated asset located within the study area, located immediately adjacent to the Site boundary. The farm is not mapped on the Milton Tithe map of 1841, but it is depicted, and labelled as 'New Farm', on the first edition 6" OS map dated 1883. The OS map shows a U-shaped farmstead with the southern side open. Whilst some elements of the complex of buildings may have been rebuilt, the full extent of the farmstead appears to be extant. It comprises a two-storey brick-built barn to the north, flanked by single-

storey linear ranges to either side. A farmhouse is present at the south end of the western range although it is unlikely that this is the original 19th century farmhouse. The roofing materials are generally slate, except for the eastern range which has been re-roofed in corrugated metal sheets. The farmstead's heritage value is derived from its historical and architectural interests as a largely complete example of a mid- to -late-19th century planned farmstead. The setting of the farmstead has always featured the Great Western Railway running east-west a short distance to the north of the buildings, and it is now flanked by the A4130 which is c.75m north of the asset. The farmland was therefore most likely focused on the land to the east, south and west of the farm. The A34 has been constructed c.650m south of the buildings within its former farmland, but aside from that the surroundings have remained largely undeveloped and the agricultural character of the setting therefore contributes to the understanding of the asset and its heritage value. The road and railway to the north of the asset form the limit of its setting on that side. Due to the proximity of the scheme to the asset, it has the potential to undergo change to its setting as a result of the Scheme and it will therefore be assessed in the ES.

- 5.3.5 Hartwright House **[A254]** is a non-designated asset within the study area, located immediately adjacent to the Site boundary. The house is not mapped on the Appleford Tithe map of 1839, but it is depicted on the first edition 6" OS map of 1883 as a small rectangular building with an offshoot to its north side, within a small garden plot. The house is of two storeys, brick-built and rendered, under a tiled roof. The windows throughout have been replaced. The building derives its heritage value from its historical interest as part of the landscape of the 19th century, however alterations to the building such as the external rendering and the replacement of windows has severely diminished its heritage value to the point where this asset is considered to be of negligible heritage value. The asset's setting is its garden plot and its placement by the side of the lane to its west, as depicted on the historic maps and this setting remains including mature planting on the boundaries of the plot. Owing to the asset's negligible value and the lack of potential for significant effects to the asset as a result of the Scheme through change to its setting, this asset has been scoped out of further assessment in the ES.
- 5.3.6 Appleford Crossing Cottage **[A255]** is a non-designated asset within the study area, located immediately adjacent to the Site boundary. It is not mapped on the Appleford Tithe map of 1839, but it is depicted on the first edition 6" OS map of 1883. The cottage is located next to a level crossing on the Great Western Railway and it likely served as the house for the crossing master. The building is of two storeys, brick built, with a tiled roof and end stacks. The building has been significantly extended to its north side, more than doubling its original size. It has also been rendered and the windows throughout have been replaced. The building has heritage value derived from its architectural and historic interest as part of the infrastructure of the Great Western Railway. Its designer and construction date are not known, however, so a link with Brunel as a possible designer cannot be established. The architectural interest of the building is severely diminished by the alterations that have taken place in recent years, however the historic interest as part of the railway remains. This interest is informed by the setting of the asset adjacent to the Appleford level crossing, and this setting therefore contributes to its significance. Due to the proximity of the scheme to the asset, it has the potential to undergo change to its setting as a result of the Scheme and it will therefore be assessed in the ES.
- 5.3.7 Bridge Farmhouse **[A256]** is a non-designated asset within the study area, located approximately 115m east of the Site boundary. It is not mapped on the Appleford Tithe map of 1839, but it is depicted on the first edition 6" OS map of 1883, as 'Bridge Farm'. The map shows the farmhouse as a large roughly square building with two projecting wings on its north side, situated to the south of a U-shaped farmstead formed into two foldyards. The farmhouse and farm were reputedly built after the construction of the Great Western Railway divided an existing farm in Appleford in two (Appleford History website). This explains the name of farm, taking its name from the grade II listed Appleford Railway Bridge **[A91]** a short distance to the south-east of the farm. The farmstead has been demolished, but the farmhouse remains. It is brick-built with a multi-pitch and hipped roof. The building has architectural and historic interest as a moderately wealthy polite farmhouse of the mid-19th century. The asset's setting has been significantly altered through the loss of its farmstead and it is now understood in the landscape as a large house as opposed to a former farmhouse. The building lies within a large plot bounded to the east by the railway line with a formal garden to its south side, now including a swimming pool. Dense mature planting is present along the east and south

boundaries of the plot. The surrounding farmland to the north and west of the building no longer makes a meaningful contribution to the asset's significance, except in providing a pleasant outlook on approach. This is due to loss of the farm buildings and the lack of a visual connection between the two. Although the building is named in relation to the grade II listed Appleford Railway Bridge **[A91]** there is no setting relationship between the two assets. Although the asset is in proximity of the Site, the proposals in part of the Scheme is essentially minor adjustment to provide a footpath and cycleway adjacent to the existing road. No impacts are predicted resulting for this change and this asset has been scoped out of further assessment in the ES. has the potential to undergo change to its setting as a result of the Scheme and it will therefore be assessed in the ES.

- 5.3.8 The Cottages on Main Street leading into Appleford **[A257]** are a non-designated asset within the study area, located approximately 150m east of the Site. The cottages are not mapped on the Appleford Tithe map of 1839, but they are depicted on the first edition 6" OS map of 1883 as one of small collection of buildings on the outskirts of the settlement. The other buildings shown have been demolished. The asset comprises a pair of semi-detached cottages of two-storeys, brick-built and now covered in a roughcast render. They have a pitched, tiled roof featuring end and ridge stacks. The windows throughout have been enlarged and replaced with UPVC and the southernmost cottage has had further alteration in the form of a slightly projecting bay window and an upper floor window in a gabled surround that pierces the ridge line. The cottages' heritage value is derived from their historic interest as 19th century cottages on the outskirts of a rural village, however they are much-altered and this has diminished their historic and architectural interest to the point where this asset is considered to be of negligible heritage value. The setting of the asset is informed by their relation to the road and their small garden plot, though this does not make a significance contribution to their heritage value. Owing to the asset's negligible value and the lack of potential for significant effects to the asset as a result of the Scheme through change to its setting, this asset has been scoped out of further assessment in the ES.
- 5.3.9 Culham School **[A258]** is a non-designated asset located within the study area, approximately 550m west of the Site, in Culham. The school is shown on the first edition 6" OS map of 1883 and it bears a date stone of 1850. The school comprises a main rectangular range of one-storey and attic, with several single storey projecting ranges to the rear. The building shows evidence of more than one phase of construction, with decorative buff-brick banding seen on the westernmost bay, but not elsewhere. It has a cottage-style appearance with a multi-gabled roof and appears to contain a headmaster's house to one end and the schoolhouse to the other. The school's heritage value is derived from its architectural and historic interest as an example of a Victorian rural schoolhouse, still in use for its original purpose. The school is aligned onto Main Road in Culham. It has playgrounds to the rear and is located within a residential area. These features of its setting contribute to understanding of its use and significance. The asset is sufficiently distant from the Scheme, and within a residential area, such that there is no potential for significant effects to the asset as a result of the Scheme through change to its setting. This asset has therefore been scoped out of further assessment in the ES.
- 5.3.10 Wagon and Horses Public House **[A259]** is a non-designated asset located within the study area, approximately 560m north-west of the Site. The public house is shown on the first edition 6" OS map of 1883. It is located on the junction of Abingdon Road and Toll House Road to the north of Culham. The pub is of two-storeys, stone-built, under a pitched slate roof with brick end and ridge stacks. There is regular fenestration of multi-pane sashes and a low-key pub front to the ground floor containing two small bay windows flanking a single-width entrance. The building appears to have been extended its west end with the addition of a house, that also has a projecting rear wing. The historic map shows some outbuildings associated with the pub that have been demolished. It is likely that these were a cart house and stables. The building is currently vacant and boarded up. The public house has heritage value due to its historic and architectural interest as an example of a modest rural, 19th century public house, sited to take advantage of traffic on Abingdon Road; a medieval road upgraded to a turnpike in the 18th century. The setting of the public house is informed by its location on the junction of Abingdon Road and Toll House Road, the main road leading south into Culham. The pub sits within a large plot that formerly contained outbuilding, but it is now a tarmac carpark bounded by mature trees. This aspect of its setting makes a limited contribution to its significance. The Site does not lie within the asset's setting and the relationship between the

asset and the adjacent roads will be unaffected by the Scheme. This asset has therefore been scoped out of further assessment in the ES.

- 5.3.11 Zouch Farm **[A260]** is a non-designated asset located within the study area, approximately 195m south of the Site. The farm is shown on the first edition 6" OS map on 1883. The map shows the farmhouse as an irregular L-shaped building with gardens to its south side, situated to the south of a loose double U-shaped farmstead formed into three foldyards. The farmhouse and two building ranges of the former farmstead remain; comprising the central T-shaped range and the westernmost, north-south aligned range. The farm is now used as a self-storage facility and several large buildings have been constructed within an around the former farmstead. The farm probably dates to between 1815 and 1828, when Culham manor was owned by the 8th Baronet Sir Cecil Bisshopp who claimed the dormant peerage of Zouch de Haryngworth in 1815 and became Lord Zouch. The farm name demonstrates this connection and there are records in the 1830s to the new owner, Sir George Richard Brooke-Pechell, objecting to the planned course of the Great Western Railway as it ran too close to the farm. It is for this reason that the line curves eastward around Zouch Farm rather than taking a more direct route between its two Thames crossings (Culham Station History Website). The farmhouse has a grand late-Georgian style south front onto the garden, featuring two-storey of buff brick walls with red-brick detailing to the windows and quoins, and a central entrance with a fanlight and Tuscan canopy. The hipped roof is of slate with brick end stacks. To the side and rear elevations the house is in red brick. The farmstead buildings to the north are constructed in a mix of redbrick and blackened timber weatherboarding. It is not clear whether they are contemporary with the farmhouse, or later redevelopment. The farmhouse and remaining farmbuildings have heritage value that is derived from their architectural and historic interest as an example of a large planned late-Georgian and early-Victorian farm and separate farmhouse. The setting of the farm is its garden to the south of the farmhouse and the agricultural land that surrounds it on all sides. Despite the objections to the railway and its subsequent realignment, the presence of the railway is a feature within the assets setting, forming a boundary to its farmland on the east side, and with the railway bridge over the Thames to the south visible from within its grounds. To the north Abingdon Road is the main access point into the farm and has always been a feature of the asset's setting. Due to the asset's proximity to the Site, on both its west and north sides, it has the potential to undergo change to its setting as a result of the Scheme and it will therefore be assessed in the ES.
- 5.3.12 Warren Farm **[A261]** is a non-designated asset within the study area, located within the study area, approximately 770m north of the Site. The farm is shown on the first edition 6" map of 1883 as a farmhouse with gardens and orchard to its south side, located to the south-east of a double U-shaped farmstead with two foldyards. The majority of the farm, as mapped in the 19th century, is still standing. The farmhouse is of an irregular plan, in two-storeys of red brick with a pitched tiled roof and end and ridge stacks. The farm buildings are also of red brick with tiled roofs. The majority are single-storey, but there is a two-storey combination barn to north side. A blackened timber weather boarded building is also present. The farm has heritage value derives from its historic and architectural interest as a 19th century planned farm. The garden and orchard that were formerly present to the south of the farm have been largely cleared of trees and are now grass and a swimming pool has been added to the south of the house. The farm is surrounded by agricultural land to all sides and this setting contributes to the asset's heritage value. The Site does not lie within the asset's setting and it will be unaffected by the Scheme. This asset has therefore been scoped out of further assessment in the ES.
- 5.3.13 There are a group of non-designated assets located in the vicinity of the grade II* listed Culham Station **[A209]** within the study area; namely Railway Hotel **[A262]**, Railway Cottages **[A263]** Semi-detached houses **[A264]**. These assets are located within 50m to the north of the Site. The cottages are single-storey brick-built cottages under a hipped slate roof with ridge stacks. They sit adjacent to the Railway Hotel and opposite the semi-detached houses. The latter structures are both brick-built and of two storeys under pitched slate roofs with brick chimney stacks. All three assets appear contemporary and all three are shown on the first edition 6" map of 1883. Their presence is entirely related to the establishment of a railway station on the GWR at this location in the 1840s. The assets have group value with each other and with the Grade II* listed Station and adjacent Overbridge and footbridge. The assets have heritage value derived from their architectural and historic interest as a group of asset types

that are frequently found in connection with the establishment of a railway station in the 19th century. The cluster of assets has a uniformity that creates historic integrity and an easily readable historic interest. The designer of the buildings is not known and therefore they cannot be ascribed to Brunel, but they contribute to the setting and significance of Brunel's station building. The setting of the assets is informed by their relationship with each other and the railway line, both visually and functionally. The asset's form a district grouping in an enclosed setting formed by the overbridge and planting that limits views of and from the assets except from directly on Station Road west of the railway line. Despite the proximity of the assets to the Scheme, is it not considered that the Scheme has the capacity to alter this enclosed setting and group value, due to its beings focused on the west side of the railway line, away from Site. The assets have therefore been scoped out of further assessment in the ES.

- 5.3.14 Coppice House [A265] is a non-designated asset located within the study area, approximately 190m north of the Site. The farm is shown on the first edition 6" map of 1883, labelled as 'Coppice House' and comprising a large farmhouse with gardens to its south side, located to the south of a dispersed farmstead formed by two L-shaped ranges and a single north-south aligned linear range. An orchard is shown to the north-east side of the complex. It appears that the farmhouse and the farm ranges remain, although much-altered and extended. The farmhouse and farmstead have heritage value derived from its historic and architectural interest as a 19th century farm, although this is diminished somewhat by the conversion and extension of the farm buildings and the fact it is no longer a working farm. The garden and orchard that were formerly present been largely cleared of trees and are now grassed areas, with a swimming pool to the south of the farmhouse, and tennis courts in the former orchard. The boundaries of the property, to the east and south comprise a dense screening of mature trees, whilst there is a more open aspect to the west. Still, the buildings are not visible in views from within the wider landscape due to the screening effects of vegetation and the local topography. To the north, the property boundary meets the dense woodland on the southern boundary of Nuneham Courtenay Park. The landscape outside the property boundary therefore makes little contribution to its significance as former farmland that provides a rural aspect to the asset's surroundings on approach. Due to the proximity of the Site of the asset, it has the potential to undergo change to its setting as a result of the Scheme and it will therefore be assessed in the ES.

Assessment of Archaeological Potential

- 5.3.15 At the time of this draft and without the results of the trial trench evaluation the archaeological potential of those areas of the Scheme not affected by quarrying and other modern activity (Figure 21) is considered to be medium to high. At present the value of any such archaeology is assessed to be such that it would contribute to the Regional Research Framework.

5.4 Historic Landscape Sensitivity to Change

- 5.4.1 The historic landscape characterisation (Section 4.5) indicates that the landscape which the Scheme traverses has been subject to substantial change in rearrangement and use over the last two hundred years. As such the landscapes historic character is considered to be of a low sensitivity to change and indeed it could be characterised as a landscape of change.

6. Conclusions

- 6.1.1 AECOM was commissioned by OCC to prepare a cultural heritage desk-based assessment (CHDBA) in support of the planning application of the Scheme. This CHDBA first sets out the heritage baseline for the Scheme Site in order to identify all known designated and non-designated heritage assets within the Site, to determine the potential for as yet unknown buried archaeological remains to be present within the Site, and to identify heritage assets within the defined study areas that may have their settings impacted by the Scheme. This report includes an assessment of the significance, using NPPF terminology, of the known and potential heritage resources that may be impacted by scheme.

6.1.2 The assessment identified five scheduled monuments, one registered park and garden, six conservation areas, 92 listed buildings and 14 non-designated buildings within the defined study areas around the Site. Of these it was found that the Site did not form part of the following assets' settings, or that the Scheme would not change these assets' settings and would not have an impact on the significance of these assets:

- Round Barrow Cemetery at Fullamoor Plantation SM 1421606, **[A109]** Scheduled Monument
- Settlement Site at Northfield Farm SM 1002925, **[A219]** Scheduled Monument
- Settlement Site SE of Church SM 1004849, **[A76]** Scheduled Monument
- Settlement Site SM 1004853, **[A25, A26 and A28]** Scheduled Monument
- Milton Conservation Area **[A220]** and the designated and non-designated assets therein (see Tables 5-4 and 5-5);
- Sutton Courtenay Conservation Area **[A222]** and the designated assets within the study area therein (Table 5-6);
- Didcot (Old) Town Conservation Area **[A221]** and the designated assets within the study area therein (Table 5-8);
- Culham Conservation Area **[A223]** and assets **[A156, A270 and A275]** (grade II);
- Fullamoor Farmhouse **[A161]** (grade II);
- Schola Europea **[A155]** (grade II);
- Assets within Appleford (see Table 5-9);
- Road bridge over Railway (at Appleford) **[A91]** (grade II);
- Thame Lane Bridge **[A212]** (grade II);
- Engine Shed **[A66]** (grade II); and
- Railway Transfer Shed **[A65]** (grade II).

6.1.3 As there is no potential for significant effects to these assets as a result of the Scheme, they will not be taken forward for assessment in the Cultural Heritage Chapter of the Environmental Statement.

6.1.4 The assessment identified one scheduled monument, one registered park and garden, two conservation areas (and the designated and non-designated assets therein), two listed buildings and five non-designated assets that have the potential for impact from the Scheme as a result of changes to their settings, these are:

- Settlement Site N of Thames SM 1006345, **[A117]** Scheduled Monument
- Nuneham Courtenay Registered Park and Garden **[A207]** (grade I) and the listed buildings therein (see Table 5-1);
- Nuneham Courtenay Conservation Area **[A225]** and the listed buildings therein (see Tables 5-1 and 5-7);
- Clifton Hampden Conservation Area **[A224]** and the listed buildings and non-designated buildings therein (see Table 5-2 and 5-3);
- Culham Station and Ticket Office **[A209]** (grade II*);
- Culham Station Overbridge **[A160]** (grade II);
- Hill Farm **[A253]** (non-designated);
- New Farm **[A252]** (non-designated);
- Appleford Crossing Cottage **[A255]** (non-designated);
- Zouch Farm **[A260]** (non-designated); and
- Coppice House **[A265]** (non-designated).

- 6.1.5 As there is the potential for impact on these assets as a result of the Scheme they will be taken forward for assessment in the Cultural Heritage Chapter of the Environmental Statement.
- 6.1.6 The assessment of non-designated archaeological assets is based on information available from desk based research and geophysical survey. As such the following known non-designated archaeological assets within the Site will be taken forward to the Cultural Heritage Chapter of the Environmental Statement:
- Prehistoric activity and Iron Age/Roman and Saxon settlements **[A54]**;
 - Middle Iron Age and Roman settlement at Great Western Park **[A60]**;
 - Undated farmstead complex (probable Later Prehistoric to Roman date) **[A36]**;
 - Possible un-dated enclosure. Cropmark evidence of a possible un-dated enclosure **[A142]**.
 - Undated enclosures and pits. Cropmark evidence of enclosures and pits, indicating possible settlement **[A163]**.

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Annex 4 – Chapter 8: Landscape and Visual Impact



REVISED

Didcot Garden Town HIF 1 Scheme

Environmental Statement

Volume I

Chapter 8 – Landscape and Visual Impact

October 2022

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8. Landscape and Visual Impact

8.1 Introduction

- 8.1.1 This chapter of the Environmental Statement (ES) presents the likely significant landscape and visual impact effects as a result of the Housing Infrastructure Fund (HIF1) Scheme during construction and operation, on receptors within the study area; and includes a qualitative lighting assessment. This chapter should be read in conjunction with chapters 1 to 5 of this ES.
- 8.1.2 Landscape effects relate to the landscape as a resource, including physical changes to the fabric or individual elements of the landscape, its perceptual qualities, including tranquillity and landscape character.
- 8.1.3 Visual effects relate to changes to existing views from identified visual receptors (i.e. people), including residents, motorists and recreational users (including pedestrians and cyclists).
- 8.1.4 All landscape and visual effects are set out in full in Appendix 8.5 and 8.6 respectively and should be read in combination with this chapter.
- 8.1.5 This landscape and visual impact assessment (LVIA) is supported by extracts of relevant policies and published landscape studies, figures, photographs, and visualisations which can be found in Appendix 8.1 to 8.7 which should be read in combination with this chapter.
- 8.1.6 The ES chapter is also undertaken with reference to ES Chapter 7: Cultural Heritage, Chapter 9: Biodiversity, Chapter 10: Noise and Vibration and the Arboricultural Impact Assessment (AIA) (Ref 8.1) for the Scheme.

Competent Expertise

- 8.1.7 This chapter of the ES has been prepared by competent experts with relevant and appropriate experience. The Technical Lead for the LVIA is a Chartered Landscape Architect, with professional qualifications and experience as summarised in Appendix 1.1.

8.2 Legislative and Policy Framework

- 8.2.1 The following sub-sections provide specific details of the legislation and policies that are of most relevance to the landscape and visual assessment, namely where these have informed the identification of receptors and resources and their sensitivity; the assessment methodology; the potential for significant environmental effects; and required mitigation. The full text for relevant policies is set out in Appendix 8.1.

National Planning Policy

National Planning Policy Framework (NPPF), 2021

- 8.2.2 Relevant NPPF (Ref 8.2) chapters are:
- **Section 2: Achieving Sustainable Development:** which sets out the key objectives of the planning system including environmental objectives to protect and enhance the natural, built and historic environment.

- **Section 9: Promoting Sustainable Transport:** which encourages safe, secure and attractive infrastructure design which responds to local character.
- **Section 12: Achieving Well-Designed Places:** which aims to ensure developments are visually attractive as a result of their layout and landscaping, as well as being sympathetic to local character.
- **Section 15: Conserving and Enhancing the Natural Environment:** which includes protecting, maintaining and enhancing valued local environment, Areas of Outstanding Natural Beauty (AONB), and networks of green infrastructure.

District (Local) Planning Policy

South Oxfordshire District Council Local Plan 2011-2035

8.2.3 The South Oxfordshire District Council (SODC) Local Plan 2011-2035 (Ref 8.3) adopted in December 2020 sets the vision, objectives and policy for SODC. The following policies are relevant to LVIA:

- **Policy TRANS1b: Supporting Strategic Transport Investment and Policy TRANS3: Safeguarding of Land for Strategic Transport Schemes:** which identify and support the Scheme and safeguard land for strategic highway improvements, such that the Scheme is principally within an area safeguarded for highway infrastructure.
- **Policy ENV1: Landscape and Countryside:** which seeks to protect the landscape and scenic beauty of the North Wessex Downs AONB and its setting. The policy requires development proposals that could affect the special qualities of an AONB (including the setting of an AONB) to prepare a LVIA. Policy ENV1 also seeks to protect the landscape, countryside and rural areas of South Oxfordshire from harmful development, with consideration to trees; hedgerows; irreplaceable habitats; the River Thames; other watercourses; the setting of settlements of special character; topographical features; areas of cultural and historic value; important views and skylines; and perceptual factors such as tranquillity and rarity. Supporting text for the policy states that significant weight will also be given to protecting non-designated landscapes, the countryside and green infrastructure assets from harm.
- **Policy ENV8: Conservation Areas:** which requires development within or in the setting of a conservation area to conserve or enhance its special interest, character, setting and appearance. This should take into account important views within, into or out of conservation areas.
- **Policy ENV12: Pollution Impact of Development on Human Health, the Natural Environment and/or Local Amenity:** which states that the consideration of the merits of development proposals will be balanced against the adverse impact on human health, the natural environment and/ or local amenity, including impacts of artificial light.
- **Policy DES1: Delivering High Quality Development:** which requires all new development to be of a high-quality design that uses land efficiently while respecting the existing landscape character and incorporating green and blue infrastructure.
- **Policy DES2: Enhancing Local Character:** which requires all new development to be designed to reflect the positive features that make up the character of the local area, and physically and visually enhance and complement the surroundings. This should be informed by context analysis and take account of existing local character assessments.

- **Policy DES6: Residential Amenity:** which states that development proposals should demonstrate that they will not result in significant adverse impacts on the amenity of neighbouring uses, with consideration to visual intrusion and external lighting.

Vale of White Horse District Council Local Plan 2031 Part 1

8.2.4 The Vale of White Horse District Council (VoWHDC) Local Plan 2031 Part 1 (Ref 8.4) adopted in December 2016 provides the spatial strategy and policies for VoWHDC. The following policies are relevant to LVIA.

- **Core Policy 17: Delivery of Strategic Highway Improvements within the South-East Vale Sub-Area:** which safeguards land for strategic highway improvements within the South-East Vale Sub-Area, such that the Scheme is principally within an area safeguarded for highway infrastructure.
- **Core Policy 33: Promoting Sustainable Transport and Accessibility:** which promotes sustainable transport and accessibility and states that “*The Council will work with Oxfordshire County Council and others to ... v.) ensure that transport improvements are designed to minimise any effects on the amenities, character and special qualities of the surrounding area, ...*”.
- **Core Policy 37: Design and Local Distinctiveness:** which supports design and local distinctiveness and states that “*All proposals for new development will be required to be of high quality design*”.
- **Core Policy 44: Landscape:** which seeks to protect the landscape of the Vale of White Horse from harmful development, and protect trees, important views and skylines, landscape settings, and tranquillity.

Vale of White Horse District Council Local Plan 2031 Part 2

8.2.5 The VoWHDC Local Plan 2031 Part 2 (Ref 8.5) adopted in October 2019 provides additional development management policies for the Vale of White Horse District. The following policies are relevant to LVIA:

- **Development Policy 21: External Lighting:** which sets out measures to ensure that development involving external lighting is appropriately designed and located.
- **Development Policy 23: Impact of Development on Amenity:** which sets out measures to minimise the impact of development on neighbouring amenity.
- **Development Policy 29: Settlement Character and Gaps:** which sets out measures to ensure that proposals do not compromise important gaps between settlements.

Neighbourhood Planning Policy

8.2.6 The Site crosses the following designated neighbourhood plan areas:

- **Burcot and Clifton Hampden**, which has published a pre-submission draft of a neighbourhood plan (the relevant aspects are reviewed below);
- **Culham**, which is a designated area, but is yet to publish a draft neighbourhood plan or draft policies; and
- **Sutton Courtenay**, which is a designated area, but is yet to publish a draft neighbourhood plan or draft policies.

Burcot and Clifton Hampden Neighbourhood Plan 2011-2034

- 8.2.7 The Parish of Burcot and Clifton Hampden published a pre-submission draft of their Neighbourhood Plan (Ref 8.6) in November 2020. The plan is not yet adopted but will gain weight as it moves through the examination process to a referendum. The following policies are relevant to LVIA and are listed for reference.
- 8.2.8 **Policy BCH6: Design Principles in Clifton Hampden:** which states that development proposals will be supported, provided they sustain and enhance the distinctiveness of the village and where appropriate, the character and setting of the conservation area.
- 8.2.9 **Policy BCH9: Local Landscape Character:** which states that the culturally and historically important local landscape character of the parish will be conserved and where possible enhanced.

8.3 Consultation with relevant stakeholders

- 8.3.1 An EIA Scoping Opinion Request was submitted by OCC (as the promoter) to OCC in its capacity as the Local Planning Authority (LPA) in April 2020, which sought the opinion of the LPA regarding the approach for the assessment of environmental effects resulting from the construction and operation of the Scheme. In accordance with the EIA Regulations, OCC consulted statutory stakeholders and non-statutory stakeholders where they considered it applicable. The following consultation responses detailed in Table 8.1 were received in relation to landscape and visual.

Table 8.1: Scoping Opinion and responses

ID	EIA Scoping Opinion Comment	Where addressed within the ES
1	The Landscape and Visual effects assessment should include the matters in scope set out in Chapter 8 of the Scoping Report.	Noted – this LVIA follows the scope and methodology as set out in the Scoping Report.
2	The Landscape and Visual Impact Assessment (LVIA) should assess impacts on both the North Wessex Downs (NWD) AONB and its setting.	This LVIA includes an assessment of the Scheme impacts on the AONB, in Section 8.9.
3	The Scoping Report states that the LVIA will include a qualitative assessment of night-time lighting. The NWD AONB are currently in the process of preparing lighting guidance as they are increasingly concerned about the impact of lighting on the natural qualities and beauty of the AONB. Lighting should be kept to a minimum and as sensitive as possible.	The LVIA includes a qualitative assessment of lighting impacts, including lighting impacts upon the AONB in Section 8.9.
4	The lighting impact will not only have to be considered in the context of the AONB but also with regard to other landscape and visual receptors. The Scoping Report scopes out night time assessment from Public Rights of Ways (PRoWs) as it considers that people will not be walking these routes at night. A more differentiated approach is required and night time views from some selected viewpoints (e.g. Wittenham Clumps) and PRoWs will need to be scoped in as some locations are likely to still be used after sunset especially during the winter months.	The scope of viewpoints to be used for the night-time assessment were reviewed after receipt of the EIA Scoping Opinion and additional viewpoints were included from a number of locations, including the Wittenham Clumps. The viewpoints for night time photography were discussed and agreed with the Landscape Officers from OCC, SODC and VoWHDC, as set out in Table 8.2 and Table 8.3.

ID	EIA Scoping Opinion Comment	Where addressed within the ES
5	In line with GLVIA (Guidelines for landscape and visual impact assessment) it is important that the design process and assessment process are interactive and that the LVIA is used to inform the scheme design e.g. what road alignment option to choose near Culham, and how to design the bridges (the Didcot Science Bridge and the Thames Crossing). The design of the bridges and the roundabouts, and the related vegetation loss are of particular relevance in landscape and visual terms.	The LVIA has informed the Scheme design process. Section 8.8 of this LVIA summarises the environmental design of the Scheme.
6	The Scoping Report highlights that the loss of vegetation is likely to be a major factor in causing landscape and visual impacts. In order to reduce impacts, it is important that the loss of existing mature vegetation is avoided as much as possible. If this is not possible, then it is important that sufficient space for mitigation planting is provided alongside the scheme to mitigate impacts in the long-term. This will require the site boundary not to be drawn too tightly. Related to this appropriate tree surveys to BS 5837:2012 will be required.	A detailed arboricultural survey compliant with BS 5837:2012 was undertaken early in the Scheme design process and has informed the Scheme design, namely, to retain as many high value trees as possible, such as north of Clifton Hampden.
7	The LVIA should also give consideration to cumulative impacts especially in the context of the large number of existing and proposed developments in or near Didcot and its surrounds and include the Grade I listed parkland at Nuneham Courtenay which has elevated views towards both the proposed new River Thames Crossing and Clifton Hampden bypass.	The LVIA includes an assessment of cumulative landscape and visual effects, as set out in Section 8.9 and Appendix 8.7.
8	All landscape and visual receptors could experience significant effects and they will therefore need to be clearly scoped into the assessment. This should include from institutional premises including the Europa School.	The scope of the landscape and visual receptors has been refined in consultation with Landscape Officers at OCC, SODC and VoWHDC, as set out in Section 8.3.
9	The Environmental Statement should include a full assessment of the potential impacts of the development on local landscape character using landscape assessment methodologies.	The LVIA includes a detailed assessment of landscape effects at different scales of landscape character, including local landscape character – refer to Section 8.9.
10	The character and distinctiveness of the area should be assessed, with the siting and design of the proposed development reflecting local design characteristics and, wherever possible, using local materials. The Environmental Statement should detail the measures to be taken to ensure the design will be of a high standard, as well as detail of the layout alternatives considered together with justification of the selected option in terms of landscape impact and benefit.	The LVIA has informed the Scheme design process. Section 8.8 of this LVIA summarises the environmental design of the Scheme.
11	The assessment should refer to the relevant National Character Areas.	The LVIA includes an assessment of landscape effects on the National Character Areas – refer to Section 8.9.

ID	EIA Scoping Opinion Comment	Where addressed within the ES
12	The work carried out as part of the visual impact assessment of the site may also inform the consideration of the development against national and development plan Green Belt policy in the planning application documentation.	An assessment of the Scheme in relation to Green Belt policy is set out in the Planning Statement (as submitted with the planning application).
13	The proposed LVIA scoping and methodology is acceptable. The methodology tables refer to residential receptors, however section 8.7 states that representative viewpoints will be from publicly accessible locations such as public rights of way and roads. Whilst this is an acceptable methodology, assessment should be made of the change to residential properties or other non-accessible receptors such as the Europa School and associated playing fields if relevant to the Option being assessed.	The LVIA includes an assessment of impacts to private locations such as residential properties and other non-accessible receptors. This is done with reference to publicly accessible locations to ascertain viewpoints, a review of on-line mapping and is based on professional judgement.

Consultation with Oxfordshire County Council

8.3.2 The EIA Scoping Report defined the study area for the LVIA, the proposed viewpoints for the visual assessment, the visualisation types, and the viewpoints for night-time assessment will be agreed with OCC prior to the preparation of the LVIA.

8.3.3 A letter was issued to the OCC Landscape Officer on the 18th August 2020 setting out the Applicant's proposed:

- LVIA study area;
- Representative viewpoints;
- Visualisation types for each representative viewpoint; and
- Representative viewpoint locations to be used for the night-time assessment.

8.3.4 Table 8.2 summarises the comments made by OCC, and actions taken by the Applicant.

Table 8.2: Consultation with OCC

Matter for Agreement	OCC Comment (paraphrased)	Applicant Response (paraphrased)
LVIA Study Area	The study area is acceptable.	No further comment.
Representative Viewpoints	<p>The proposed viewpoints are a comprehensive list.</p> <p>A view from Moor Ditch should be included although visibility of the Scheme might be restricted by the railway line and intervening vegetation.</p> <p>Consider a viewpoint from footpath 171/15/20 towards the Culham roundabout.</p> <p>Consider a viewpoint from the approach to the roundabout near Culham coming from the north-east travelling west.</p>	<p>Two viewpoints from the Moor Ditch have been included (viewpoints 12 and 13) in the LVIA.</p> <p>A viewpoint from footpath 171/15/20 has been included (viewpoint 30) in the LVIA.</p> <p>No viewpoint has been included from the approach to the roundabout near Culham as this is currently a private location. The receptor has been assessed with reference to other representative viewpoints.</p>

Matter for Agreement	OCC Comment (paraphrased)	Applicant Response (paraphrased)
Visualisations	The proposed visualisations are acceptable.	No further comment.
Viewpoint locations for night-time assessment	<p>Is the junction with the A415 sufficiently covered by VP28?</p> <p>The arguments that PRow's don't tend to be used after nightfall are understood, but this does not necessarily apply to Wittenham Clumps (which has already been included) or the Thames Path.</p> <p>It is good to see VP30 included at Culham, but is the best location to assess the proposals at the Culham Roundabout?</p>	<p>VP28 is suitable to cover the junction with the A415. The purpose of the night views is to provide a photographic record of the general sources of light in the area, to inform the qualitative assessment on lighting impacts to the character of the area and night sky. A sample of viewpoints is appropriate.</p> <p>A night-time viewpoint has been included in the assessment from Wittenham Clumps, but not the Thames Path. This is because of the context of the Wittenham Clumps where the car park and elevated position means people can easily park up at night and take in the view of the area.</p> <p>At the Culham roundabout there is existing street lighting around the junction and along the road. VP30 is considered the most appropriate location to capture this, and in the context that it is in front of the visual receptor at Fullamoor, which is the closest visual receptor.</p>

Consultation with SODC and VoWHDC

8.3.5 As with OCC, a letter was issued to the Landscape Officers covering both SODC and VoWHDC on 19 August 2020.

8.3.6 Table 8.3 summarises the comments made by the SODC and VoWHDC Landscape Officer, and actions taken by the Applicant.

Table 8.3: Consultation with SODC and VoWHDC

Matter for Agreement	SODC and VoWH Comment (paraphrased)	Applicant Response (paraphrased)
LVIA Study Area	The study area is acceptable.	No further comment.
Representative Viewpoints	The proposed viewpoints are acceptable, although have views from the Moor Ditch been considered?	Two additional views from the Moor Ditch (viewpoints 12 and 13) have been proposed and agreed for inclusion in the assessment.
Visualisations	The proposed visualisations are acceptable.	No further comment.
Viewpoint locations for night-time assessment	The proposed viewpoints for night-time assessment are acceptable.	No further comment.

8.4 Assessment Methodology

LVIA Methodology

8.4.1 The LVIA is based on a methodology taken from:

- GLVIA 3rd Edition, published by the Landscape Institute and Institute for Environmental Management and Assessment (Ref 8.7);
- The Landscape Institute's Technical Guidance Note 02/21: Assessing landscape value outside national designations, 2021 (Ref 8.8);
- Design Manual for Roads and Bridges (DMRB) LA 107 Landscape and Visual Effects (Ref 8.9), published by the Department for Transport and Highways England, which provides best practice in the assessment of landscape and visual effects for highway infrastructure;
- DMRB LA 104 Environmental Assessment and Monitoring (Ref 8.10), published by the Department for Transport (DfT) and Highways England (HE), which provides best practice in the assessment of environmental effects for highway infrastructure; and
- DfT, TAG Unit A3, EIA, Landscape and Townscape Effects, 2021 (Ref 8.11).

8.4.2 The LVIA methodology is set out in full in Appendix 8.2 with the main aspects summarised below.

Establishing the Baseline

8.4.3 The landscape and visual baseline assessments have been based on desk study and fieldwork. Fieldwork was undertaken between January 2020 and March 2021 and included both summer and winter inspections to take account of the changing seasons and the differences between vegetation being in leaf or not.

8.4.4 Establishing the landscape baseline involved the identification of landscape receptors within the study area (refer to Section 8.7). Landscape receptors are referred to in LA 107 as a "*defined aspect of the landscape resource that potentially could be affected by the project*". Receptors have been identified through a review of published landscape character assessments, maps and aerial photography, relevant planning policy and fieldwork surveys.

8.4.5 Establishing the visual baseline involved the identification of visual receptors within the study area. LA 107 defines visual receptors as "*individuals and/or defined groups of people who potentially could be affected by a project*". Receptors include residents, users of PRow and motorists.

Sensitivity of Receptors

8.4.6 The following methodology for the landscape assessment has been agreed with been agreed with OCC, VoWHDC and SODC via the Scoping Report. The sensitivity of landscape receptors has been identified through a consideration of value and susceptibility in accordance with Paragraph 3.18 of LA 107 which states the "*assessment of the sensitivity of landscape receptors shall report on a combined judgement of the susceptibility of the receptor to the proposed change from the baseline situation; and the value attached to that receptor.*"

8.4.7 The criteria by which landscape value and susceptibility have been judged are set out in Table 8.1 and Table 8.2 in Appendix 8.2.

8.4.8 The sensitivity of landscape receptors has been reported in accordance with the criteria provided in Table 3.22 of LA 107, which are reproduced in Table 8.4, as agreed and set out in paragraph 8.5.6 of the Scoping Report.

Table 8.4: Landscape sensitivity

Classification	Description
Very High	Landscapes of very high international/ national importance and rarity or value with no or very limited ability to accommodate change without substantial loss/ gain (i.e. national parks, internationally acclaimed landscapes - UNESCO World Heritage Sites).
High	Landscapes of high national importance containing distinctive features/ elements with limited ability to accommodate change without incurring substantial loss/ gain (i.e. designated areas, areas of strong sense of place - registered parks and gardens, country parks).
Medium	Landscapes of local or regional recognition of importance able to accommodate some change (i.e. features worthy of conservation, some sense of place or value through use/ perception).
Low	Local landscape areas or receptors of low to medium importance with ability to accommodate change (i.e. non-designated or designated areas of local recognition or areas of little sense of place).
Negligible	Landscapes of very low importance and rarity able to accommodate change.

8.4.9 The location of people's views (visual receptors) and the following methodology for the assessment of visual effects have been agreed with OCC, VoWHDC and SODC via the Scoping Report. The sensitivity of visual receptors has been identified through a consideration of value and susceptibility in accordance with LA 107, with the note at the top of page 30 of LA 107 stating that the process of determining sensitivity is to *"judge susceptibility of the receptor to change and value of the views separately, combining them together to arrive at the sensitivity of the visual receptor or visual sensitivity."*

8.4.10 The criteria by which visual value and susceptibility have been judged are set out in Table 8.5 and Table 8.6 in Appendix 8.2.

8.4.11 The sensitivity of visual receptors is based on professional judgement (in accordance with GLVIA 3) and has been informed by the criteria set out in Table 3.41 of LA 107, which are reproduced in Table 8.5, as agreed and set out in paragraph 8.5.9 of the Scoping Report.

Table 8.5: Visual sensitivity

Classification	Description
Very High	<ol style="list-style-type: none"> 1. Static views from and of major tourist attractions; 2. Views from and of very important national/international landscapes, cultural/ historical sites (e.g. National Parks, UNESCO World Heritage sites); 3. Receptors engaged in specific activities for enjoyment of dark skies.
High	<ol style="list-style-type: none"> 1. Views by users of nationally important PRow/ recreational trails (e.g. national trails, long distance footpaths); 2. Views by users of public open spaces for enjoyment of the countryside (e.g. country parks); 3. Static views from dense residential areas, longer transient views from designated public open space, recreational areas; 4. Views from and of rare designated landscapes of national importance.

Classification	Description
Medium	5. Static views from less populated residential areas, schools and other institutional buildings and their outdoor areas; 6. Views by outdoor workers; 7. Transient views from local/ regional areas such as public open space, scenic roads, railways or waterways, users of local/regional designated tourist routes of moderate importance; 8. Views from and of landscapes of regional importance.
Low	9. Views by users of main roads or passengers in public transport on main arterial routes; 10. Views by indoor workers; 11. Views by users of recreational/ formal sports facilities where the landscape is secondary to enjoyment of the sport; 12. Views by users of local public open spaces of limited importance with limited variety or distinctiveness.
Negligible	13. Quick transient views such as from fast moving vehicles; 14. Views from industrial area, land awaiting re-development; 15. Views from landscapes of no importance with no variety or distinctiveness

Assessment of Impacts

8.4.12 The LVIA has been undertaken for the following scenarios, for which the magnitude of impact (change) and effects have been assessed:

- Construction Phase (winter) – with deciduous vegetation not in leaf so as to represent a worst-case scenario through greater potential Scheme visibility than compared to summer conditions and assuming peak construction activity;
- Year 1 (winter) – to account for deciduous vegetation not being in leaf nor any proposed landscape planting by the Scheme having established or matured, and the Scheme being operational; and
- Year 15 (summer) – to account for vegetation being in leaf and any new landscape planting having established or matured (such that it is taller in height than at year 1), and the Scheme being operational.

8.4.13 In accordance with GLVIA 3 and DMRB LA 107, the classification and significance of landscape and visual effects are derived by considering the combination of the sensitivity of the receptors and the magnitude of impact from the Scheme.

8.4.14 The criteria contained within DMRB LA 107 and reproduced in Table 8.6 have been adopted in the assessment to identify the magnitude of landscape effects (adverse or beneficial) that the Scheme has the potential to have on landscape character and its component features and elements.

Table 8.6: Magnitude and nature of effect on the landscape

Magnitude of effect (change)		Description
Major	Adverse	Total loss or large-scale damage to existing landscape character or distinctive features or elements; and/ or addition of new uncharacteristic, conspicuous features or elements (i.e. road infrastructure).
	Beneficial	Large scale improvement of landscape character to features and elements; and/ or addition of new distinctive features or elements, or removal of conspicuous road infrastructure elements.

Magnitude of effect (change)		Description
Moderate	Adverse	Partial loss or noticeable damage to existing landscape character or distinctive features or elements; and/ or addition of new uncharacteristic, noticeable features or elements (i.e. road infrastructure).
	Beneficial	Partial or noticeable improvement of landscape character by restoration of existing features or elements; or addition of new characteristic features or elements or removal of noticeable features or elements.
Minor	Adverse	Slight loss or damage to existing landscape character of one (maybe more) key features and elements; and/or addition of new uncharacteristic features and elements
	Beneficial	Slight improvement of landscape character by the restoration of one (maybe more) key existing features and elements; and/or the addition of new characteristic features
Negligible	Adverse	Very minor loss, damage or alteration to existing landscape character of one or more features and elements
	Beneficial	Very minor noticeable improvement of character by the restoration of one or more existing features and elements.
No change	No noticeable alteration or improvement, temporary or permanent, of landscape character of existing features and elements.	

8.4.15 As part of the agreed assessment methodology (as set out in paragraph 8.5.6 of the Scoping Report), the criteria contained within LA 107 and reproduced in Table 8.7 have been adopted in the assessment to identify the magnitude of visual impacts (adverse or beneficial) that the Scheme has the potential to have on visual receptors.

Table 8.7: Magnitude of visual impacts

Classification	Description
Major	The project, or a part of it, will become the dominant feature or focal point of the view.
Moderate	The project, or a part of it, will form a noticeable feature or element of the view which is readily apparent to the receptor.
Minor	The project, or a part of it, will be perceptible but not alter the overall balance of features and elements that comprise the existing view.
Negligible	Only a very small part of the project work or activity will be discernible or being at such a distance it will form a barely noticeable feature or element of the view.
No Change	No part of the project work or activity will be discernible.

Classification and significant of landscape and visual effects

8.4.16 The approach to deriving the significance of landscape and visual effects takes account of the sensitivity of the receptor and the magnitude of impacts, informed by Table 3.8.1 of DMRB LA 104 (Ref 8.10), as reproduced in Table 8.8.

Table 8.8: Classification of landscape and visual effects

Sensitivity of receptor	Magnitude of impact				
	No Change	Negligible	Minor	Moderate	Major
Very High	Neutral	Slight	Moderate or Large	Large or very large	Very Large
High	Neutral	Slight	Slight or Moderate	Moderate or Large	Large or very large

Sensitivity of receptor	Magnitude of impact				
	No Change	Negligible	Minor	Moderate	Major
Medium	Neutral	Neutral or Slight	Slight	Slight or Moderate	Moderate or Large
Low	Neutral	Neutral or Slight	Neutral or Slight	Slight	Slight or Moderate
Negligible	Neutral	Neutral	Neutral or Slight	Neutral or Slight	Slight

8.4.17 Very large, large and moderate (adverse or beneficial) effects are deemed to be 'significant' effects. Slight (adverse or beneficial) and neutral effects are determined as being 'not significant' effects.

8.4.18 As part of the agreed assessment methodology (as set out in paragraphs 8.5.6 and 8.5.9 of the Scoping Report), where the classification of effect differs from the guide as a result of professional judgement, the supporting justification is provided in the assessment text. Additionally, where Table 8.9 includes two significance categories, evidence is provided to support the reporting of a single significance category, in accordance with DMRB LA 104.

Qualitative Lighting Assessment Methodology

8.4.19 The methodology for the lighting assessment follows the same approach as set out above for 'day-time' assessment and uses the same study area and landscape character areas and the same criteria for impacts and effects.

8.4.20 The lighting assessment is undertaken for the operational phase of the Scheme, as construction lighting will be temporary.

8.4.21 Where existing lighting sources are identified, a subjective judgement has been made on the existing levels of glare, light spill and upwards lighting (sky glow) to relate the character of the night sky to the Institution of Lighting Professionals' Environmental Zones (Ref 8.12), as set out in Table 8.9.

Table 8.9: Institute of Lighting Professionals Environmental Zones

Zone	Surrounding	Lighting Environment	Examples
E0	Protected	Dark	Astronomical Observable dark skies, UNESCO starlight reserves, IDA dark sky places
E1	Natural	Dark	Relatively uninhabited rural areas, National Parks, Areas of Outstanding Natural Beauty, IDA buffer zones etc
E2	Rural	Low district brightness	Sparsely inhabited rural areas, village or relatively dark outer suburban locations
E3	Suburban	Medium district brightness	Well inhabited rural and urban settlements, small town centres of suburban locations
E4	Urban	High district brightness	Town / City centres with high levels of night-time activity

8.4.22 The assessment of new lighting is based on identifying the potential sources of light and their likely change to the night sky via new glare, light spill or sky glow.

8.5 Assessment Assumptions and Limitations

- 8.5.1 The fieldwork and photography have been undertaken from publicly accessible areas (i.e. PRow) or pavements adjacent to residential properties or roads. As viewpoint photography has not been undertaken from private properties, professional judgement has been used to assess the potential effect to these private receptors in combination with reviews of on-line aerial mapping.
- 8.5.2 The assessment of the impacts during Scheme construction considers a peak construction scenario i.e. when construction is happening across all of the Scheme at the same time. Thus the assessment does not consider the impacts of Scheme construction phasing. The assessment is based on winter conditions such that existing vegetation is not in leaf, which is considered to represent the worst-case.
- 8.5.3 The assessment of operational impacts of the Scheme at year 1 assumes that:
- Areas of grass seeding will have been implemented, but will not have fully established; and
 - Whips/transplants and hedgerow planting will be between 0.5 m and 1 m in height and stand-alone trees will be 1.8 m to 3.5 m in height. This planting along with existing vegetation will not be in leaf as the assessment is based on winter conditions.
- 8.5.4 The assessment of operational impacts of the Scheme at year 15 assumes that:
- The areas of proposed landscaping will have successfully established as a result of the maintenance set out in the Outline Landscape and Biodiversity Management Plan (OLBMP) (Ref 8.21);
 - Whips/transplants (new tree planting) will have grown to be between 6 m and 7.5 m in height;
 - Hedgerows will have grown to be between 1.5 m and 2.5 m in height; and
 - Stand-alone trees will have grown to be between 6 m and 9 m in height.
- 8.5.5 The year 15 assessment season assume summer conditions, so all the proposed planting listed above, and the existing vegetation across the study area will be in leaf.
- 8.5.6 The lighting assessment assumes that lighting columns and roadside lighting will be designed to minimise light spill, glare and sky glow via the use of cowls, directional lighting and the minimum lux levels to address operational requirements.

8.6 Study Area

- 8.6.1 This section sets out the stages undertaken to determine the LVIA study area. The study area is the extent across which the Scheme may give rise to significant landscape or visual effects. The Site is shown on Figure 8.1.

Stage 1 – Area of Search

- 8.6.2 The starting point for the study area was an initial 5 km radius 'area of search' from the Scheme centreline. This was considered appropriate, as no significant landscape or visual effects are considered likely beyond 5 km from the Scheme, due to the nature of the Scheme and the combination of distance, landform and vegetation patterns.
- 8.6.3 To ascertain the theoretical bare-earth visibility of the Scheme across this 5 km area of search, 10 individual points were defined along the Scheme alignment. Each point

represented a 4.5 m high heavy goods vehicle (HGV), located at the most likely visible parts of the Scheme, for example on bridges.

8.6.4 Each of the 10 points were then subject to 'bare-earth' Zone of Theoretical Visibility (ZTV) computer modelling, to determine the theoretical visibility of the lorry. As a 'bare-earth' ZTV, the modelling does not include vegetation or buildings, which could provide screening of views, and therefore it represents a worst-case scenario, in accordance with the GLVIA 3.

8.6.5 The 10 individual points and their associated ZTVs were then combined into a consolidated ZTV, as illustrated on Figure 8.2.

8.6.6 The 10 points used to define the consolidated ZTV are illustrated on Figure 8.2 and are:

1. A4130 Milton Park Roundabout – modelled at 4.5 m above the proposed ground level to represent the maximum visibility of a HGV using the road;
2. Didcot Science Bridge – modelled at 14 m above the proposed ground level to represent a HGV crossing the high point of the bridge (9.5 m);
3. North of Didcot – modelled at 4.5 m above the proposed ground level to represent a HGV along the new link road;
4. Appleford Rail Sidings – modelled at 12.5 m above the proposed ground level to represent a HGV crossing the high point of the bridge (8 m). The point has been modelled above the ground level of the railway line, which is in cutting;
5. Junction west of Appleford – modelled at 4.5 m above the proposed ground level to represent a HGV at the junction;
6. River Thames Crossing – modelled at 10.5 m above the proposed ground level to represent a HGV crossing the high point of the bridge (6 m) over the River Thames;
7. A415 junction – modelled at 4.5 m above the proposed ground level to represent a HGV at the junction;
8. Culham Science Centre Junction – modelled at 4.5 m above the proposed ground level to represent a HGV at the junction;
9. Clifton Hampden Bypass – modelled at 6.5 m above the proposed ground level to represent a HGV on a small embankment (2 m); and
10. B4015 junction – modelled at 4.5 m above the proposed ground level to represent a HGV at the junction.

8.6.7 Figure 8.2 indicates that the theoretical bare-earth visibility of the Scheme extends as far as the full 5 km area of search in part, due to the low lying and gently undulating topography of the Thames valley and the low-lying position of the Site on the valley floor. The theoretical visibility of the Scheme extends between:

- Abingdon-on-Thames in the north;
- Dorchester and Drayton St. Leonard in the east;
- Didcot and Harwell in the south including part of the North Wessex Downs AONB east and south-west of Didcot; and
- Steventon and Drayton in the west.

Stage 2 – Site Walkover

- 8.6.8 The bare-earth ZTV as detailed above formed the basis of a site walkover of the ‘area of search’ which found that the actual Scheme visibility will be substantially reduced by the extent of vegetation cover and buildings across the study area.

Stage 3 – Additional ZTV and Fieldwork

- 8.6.9 To incorporate a representation of the screening effect of the existing vegetation noted during Stage 2, an additional ZTV was prepared that included vegetation sourced from the National Forest Inventory and the National Tree Map™, which are published datasets prepared by the Forestry Commission and Bluesky Mapping respectively.
- 8.6.10 These tree and woodland datasets were merged with the terrain model for the 5 km area of search as follows:
- The National Tree Map™ was included for areas <1 km from the Scheme centreline, with the mean height of each individual tree included; and
 - The National Forest Inventory was included for areas >1 km from the Scheme centreline, with an assumed height of vegetation 15 m above ground level.
- 8.6.11 The ZTV including this vegetation is presented on Figure 8.3 and demonstrates a much-reduced ZTV compared to the bare-earth modelling presented on Figure 8.2, particularly in relation to Abingdon-on-Thames, land to the west of Steventon and around Marsh Baldon and Drayton St. Leonard.
- 8.6.12 Figure 8.3 demonstrates that the theoretical Scheme visibility is mainly from within approximately 2 km of the Scheme, along with areas of elevated land around the village of Harwell to the south and the Wittenham Clumps to the east (in the North Wessex Downs AONB), and Drayton to the west.
- 8.6.13 Additional fieldwork (based on Figure 8.3) confirmed that taller elements of the Scheme could potentially be visible from discrete locations within much of this refined ZTV.
- 8.6.14 The fieldwork identified that from the settlements of Upton, approximately 4 km south of the Scheme, and Burcot/Dorchester to the east, a combination of distance and intervening vegetation along with the scale of the Scheme prevent the potential for significant visual effects.

Stage 4 – LVIA Study Area

- 8.6.15 The final LVIA study area is shown on Figure 8.4 and has been agreed with OCC, SODC and VoWHDC.
- 8.6.16 The boundary of the study area was drawn to reflect the ZTVs (outlined above), the fieldwork analysis, and the patterns of landform and vegetation.
- 8.6.17 With reference to Figure 8.4, the LVIA study area extends to:
- Nuneham Courtenay and an elevated ridgeline to the north;
 - Little Wittenham and the Wittenham Clumps in the east;
 - Didcot and Harwell in the south; and
 - Milton and Drayton in the west.

8.7 Baseline Conditions

Current Baseline

- 8.7.1 In accordance with GLVIA 3 and LA104, the first stage of the LVIA is to establish the baseline landscape and visual conditions within the study area.
- 8.7.2 The following section describes the landscape features across the study area shown on Figure 8.4 with reference to the following headings:
- Topography and watercourses;
 - Vegetation patterns;
 - Settlement and land use;
 - Roads, rail and PRow;
 - Designated landscapes; and
 - Tranquillity.

Topography and Watercourses

- 8.7.3 With reference to Figure 8.5, the topography of the Site is broadly flat as a result of its location within the Thames valley. The landscape rises gently from the Site across the north of the study area, as well as rising towards the North Wessex Downs in the east and south of the study area.
- 8.7.4 The south of the Site along the A4130 (west of Didcot) lies between approximately 55 m – 60 m above ordnance datum (AOD), with the land rising to the south of the Site to a high point of approximately 120 m AOD south of Harwell, approximately 3.2 km south of the Site.
- 8.7.5 Between Didcot and the River Thames the Site lies principally between 50 m – 55 m AOD but crosses elevated landform at a former landfill west of Appleford where the elevation is approximately 60 m AOD. South of this landfill and north of the Didcot B power station there is a large working landfill to the west of the Site, with an elevation currently up to approximately 75 m AOD.
- 8.7.6 North of the River Thames the land rises from approximately 50 m AOD at the river, to approximately 60 m AOD at the A415 near Culham Station. The land continues to rise very gently to the north of the A415 to the edge of the study area at approximately 65 m AOD, approximately 1 km to the north.
- 8.7.7 Between Culham Station and Clifton Hampden the Site is generally flat between approximately 55 m – 60 m AOD, with the land rising to the north to a ridgeline at approximately 85 m AOD, approximately 1.2 km north of the Site.
- 8.7.8 The east of the study area forms the fringe of the North Wessex Downs AONB, including the prominent Wittenham Clumps at approximately 120 m AOD, and an elevated ridge between the Wittenham Clumps and Didcot at approximately 80 m AOD. The land rises steeply from the lower-lying landscape of the Thames valley, to the higher elevation of the Wittenham Clumps and the ridgeline. As a result of the elevation change there are some far-reaching views across the study area to the north and west, notably from Wittenham Clumps which is a popular and promoted viewpoint.
- 8.7.9 Within the Site there are localised engineered alterations to the landform, including landfill, earthworks, bunds and embankments related to existing infrastructure and

flood defences, and water bodies formed from disused gravel pits. This gives much of the Site between Didcot and Culham an engineered character and an alteration from the underlying pattern of the Thames valley landform.

- 8.7.10 The principal watercourse through the study area is the River Thames, which flows through the north of the study area. The River Thames separates Culham and Clifton Hampden to the north of the river, from Sutton Courtenay, Appleford and Long Wittenham to the south of the river.
- 8.7.11 The study area also consists of several engineered water bodies at former gravel pits and other industrial land uses.

Vegetation Patterns

- 8.7.12 Trees and hedgerows within the Site and near to the Site boundary are generally found alongside roads, footpaths, settlement boundaries, railways and field boundaries, and as such the landscape has the perception of being well-vegetated, despite the broad areas of open agricultural and mining/industrial land uses.
- 8.7.13 The south of the Site along the A4130 (west of Didcot) is lined by mature trees and hedgerows, with a patchwork of mature hedgerows and intermittent trees across the fields to the south of the A4130, and tree belts within the Didcot B Power Station and the former Didcot A Power Station sites to the north of the A4130. The area therefore has a fairly strong sense of enclosure.
- 8.7.14 As the land rises towards Harwell in the far south of the study area, the field boundaries are characterised by distinctive mature belts of poplar trees. These tree belts generally prevent views towards the Site from the south of the study area.
- 8.7.15 The landscape between Didcot and the River Thames is more open in character, with less tree cover than in the northern and southern parts of the study area. Tree cover in this area is principally around the settlement boundaries of Didcot, Appleford, Sutton Courtenay, Culham and Long Wittenham. Hedgerows in road and field boundaries give some enclosure but allow intermittent longer-distance views. The B4016 between Appleford and Culham has open boundaries onto fields in places, allowing views onto adjacent fields and former mineral working sites.
- 8.7.16 The River Thames is lined by mature trees and riparian vegetation, forming a green corridor.
- 8.7.17 North of the River Thames and west of Culham Station the landscape is again more open in character with reduced tree cover. Field and road boundaries are generally formed by hedgerows with occasional trees. North of this area towards the northern edge of the study area there are some larger blocks of woodland across the more elevated landform.
- 8.7.18 Around Culham Science Centre (CSC) and Clifton Hampden there is increased tree cover, partly associated with the current and former parkland of Nuneham Park, which lies to the north of the area. There are distinctive mature tree belts in field boundaries between Clifton Hampden and the CSC, with small woodland copses. Larger blocks of mature woodland are found across the elevated ridgeline to the north of Clifton Hampden at Nuneham Courtenay. The area therefore generally has a sense of enclosure.
- 8.7.19 In the wider study area, woodland copses on the hills at the Wittenham Clumps are distinctive landmarks that are widely visible within the study area.

- 8.7.20 There is a group of trees (shown on Figure 7 or the AIA (Ref 8.1) between the entrance to CSC and Culham Railway Station which are subject to a Tree Preservation Order (TPO). There are no other trees in the Site which are subject to a TPO.

Settlement and Land Use

- 8.7.21 As shown on Figure 8.6, the landscape south of the River Thames has a fragmented and industrialised character. This relates to land uses including the former Didcot A Power Station, Didcot B Power Station, Milton Park industrial and commercial estate, Southmead Industrial Estate, working and former landfill sites, and gravel extraction areas and pits.
- 8.7.22 The landscape north of the River Thames has a more coherent rural pattern of fields, hedgerows and treelines. The exception is the CSC, which is a notable area of development on the northern side of the A415.
- 8.7.23 The study area consists of several settlements which from south to north are:
- The town of Didcot, which the Site extends around its north-west boundary through the former Didcot A Power Station site;
 - The village of Appleford on Thames, which the Site extends close to its western boundary; and
 - The village of Clifton Hampden, which the Site extends to the north of, between the village and CSC.
- 8.7.24 Other areas of settlement in the study area include Harwell, a village in the far south of the study area; Sutton Courtenay, Culham, Drayton and Milton in the west of the study area; and Long Wittenham in the east of the study area.

Roads, Rail and PRow

- 8.7.25 The main roads through the study area are the A34, A4130 and A415 as follows:
- The A34 passes through the west of the study area, with a junction between the A34 and A4130 at the A34 Milton Interchange forming the south-western extent of the Site. The Site does not cross the A34;
 - The A4130 connects the A34 Milton Interchange with Didcot and passes around the northern edge of the town. The A4130 is within the southern part of the Site west of Didcot, and north of Didcot; and
 - The A415 passes through the north of the study area on an east-west axis, passing to the south of CSC and centrally through the village of Clifton Hampden. The A415 is within the northern part of the Site south of CSC.
- 8.7.26 Local roads through the study area include the B4016 and B4015 as follows:
- The B4016 connects Didcot to Drayton, passing through the village of Appleford and Sutton Courtenay. The Site crosses the B4016 to the west of Appleford; and
 - The B4015 heads north from Clifton Hampden towards the A4074 outside the study area. The Site connects with the B4015 north of Clifton Hampden as the north-eastern Scheme tie-in.

8.7.27 There are two railways through the study area as follows:

- The Great Western Railway Mainline in the south of the study area which runs parallel to the A4130, separating the A4130 from Milton Park and the former Didcot A Power Station site, before passing through Didcot. The Site crosses the Great Western Railway Mainline west of Didcot; and
- The Cherwell Valley Railway Line, which is a branch line heading north from Didcot through Appleford and Culham Station towards Oxford in the north. The Site runs parallel to the Cherwell Valley Railway Line between Didcot and Culham, before crossing the Cherwell Valley Railway Line at Culham Station.

8.7.28 The study area includes a National Trail, two long-distance recreational trails, and a national cycle network route as follows:

- The Thames Path National Trail follows the north bank of the River Thames through the study area;
- The Vale Way long-distance recreational trail passes through the west of the study area, between Milton Park and Abingdon (outside the study area) to the west of Sutton Courtenay;
- The Oxford Greenbelt Way long-distance recreational trail passes through the far north of the study area, around the northern side of the CSC and through Nuneham Courtenay; and
- National Cycle Network Route (NCN) 5 crosses the study area from west-to-east from Abingdon through Sutton Courtenay and around the edge of the former Didcot A Power Station and Didcot B Power Station to Didcot, before heading north along the Moor Ditch to Long Wittenham and eastwards past the Wittenham Clumps.

8.7.29 As shown on Figure 8.7, there is a network of PRoW across the study area which connect the various areas of settlement. PRoW are identified by their code, with reference to the Oxfordshire Countryside Access Map.

Designated Landscapes

8.7.30 As illustrate on Figure 8.8, the Site is not within any statutory designated landscapes.

8.7.31 The wider study area lies partially within the North Wessex Downs AONB, with the far south of the study area south of Harwell being within the AONB, and the Wittenham Clumps in the east of the study area also within the AONB (refer to Figure 8.8).

8.7.32 There are no non-statutory local landscape designations in the study area.

8.7.33 There are several conservation areas within the study area relating principally to areas of settlement, the closest of which to the Site are Milton, Sutton Courtenay, Culham, Long Wittenham, Clifton Hampden and Nuneham Courtenay (refer to Figure 8.8).

8.7.34 Only the Milton Conservation Area has a Conservation Area Appraisal (Ref 8.19). This has been reviewed in relation to the Site and there are no identified views or character management guidelines of relevance to the Site or the Scheme.

8.7.35 The non-statutory Grade I listed Nuneham Courtenay registered park and garden lies across the elevated land in the north of the study area north of CSC and Clifton Hampden.

- 8.7.36 Whilst not a landscape designation, the part of the Site north of the River Thames lies largely within Green Belt, however, CSC, Culham Railway Station and the fields west of Culham Station are inset within the Green Belt.

Tranquillity

- 8.7.37 The DfT TAG Unit A3 defines tranquillity as:

“the remoteness and sense of isolation, or lack of it, within the landscape. This can be affected and often determined by noise levels and visual amenity resulting from the absence of built development and intrusion from traffic.”

- 8.7.38 The Campaign to Protect Rural England (CPRE) has mapped relative levels of tranquillity across England (Ref 8.13). The CPRE data is from 2007 but provides a useful reference and starting point in relation to relative levels of tranquillity in the study area.
- 8.7.39 The CPRE mapping demonstrates that within the study area the least tranquil areas are Didcot and Milton Park, reflecting the location of settlement patterns. The more tranquil areas are Nuneham Park and the Wittenham Clumps. There are areas of intermediate tranquillity identified at Appleford, Sutton Courtenay, Culham and Clifton Hampden.
- 8.7.40 Fieldwork identified that the southern part of the Site, at Didcot and Milton Park, was of very limited tranquillity due to the visual prominence of the Didcot B Power Station large-scale commercial buildings, high voltage pylons and the audible influence of the A34, A4130, and the Great Western Railway Mainline.
- 8.7.41 Fieldwork determined that the part of the Site between Didcot and the River Thames is of low tranquillity as a result of the visual and audible influence of the operational landfill and FCC Hanson sites, views of high voltage pylons, the Didcot B Power Station to the south, and the Cherwell Valley Railway Line. The area comprises a substantially modified and restored landscape which contrasts with the perception of the surrounding arable land uses, and as such the sense of remoteness is substantially reduced.
- 8.7.42 Fieldwork determined that along the River Thames there is a higher degree of tranquillity due to the sense of enclosure and separation from built-up areas, but the overhead high voltage pylons and the Cherwell Valley Railway Line reduce the sense of remoteness.
- 8.7.43 North of the River Thames, the fieldwork determined that tranquillity is low due to traffic along the A415, high voltage pylons, and views of industrial land uses to the south at Didcot/Milton Park, and to the east at CSC.
- 8.7.44 Fieldwork determined that the most tranquil part of the Site is north of Clifton Hampden. This is because there is limited visual intrusion from built form or structures such as pylons, whilst there is a strong sense of enclosure from mature tree belts which increases the perception of remoteness and tranquillity.

Published Landscape Character Assessments

- 8.7.45 The study area is covered by published character assessments at national, county, district, and designated landscape levels, therefore covering a range of scales.

8.7.46 Landscape character assessment is defined within GLVIA 3 as the:

“process of identifying and describing variation in the character of the landscape and using this information to assist in managing change in the landscape. It seeks to identify and explain the unique combination of elements and features that make a landscape distinctive.”

8.7.47 Local planning authorities use published character assessments as part of their planning policy evidence base and the published assessments often provide specific guidance or recommendations on managing landscape change.

8.7.48 The following section summarises those aspects of the published studies which are relevant to the study area and the Site.

8.7.49 The following section should be read in combination with Appendix 8.3 which provides further detail on the published National Character Areas (NCAs), Landscape Character Types (LCTs) and Landscape Character Areas (LCAs) that are within the study area.

National Character Areas, 2015

8.7.50 At the national level, NCAs have been defined and described by Natural England. England is divided into 159 NCAs, each defined by a unique combination of landscape, biodiversity, geodiversity, and economic and cultural activity.

8.7.51 As shown on Figure 8.9, the Site and most of the study area lies within NCA 108 Upper Thames Clay Vales. A small part of the of the far north of the study area lies within NCA 109 Midvale Ridge, and a part of the far south of the study area lies within NCA 116 Berkshire and Marlborough Downs. These NCAs are described in the sections below.

NCA 108 Upper Thames Clay Vales

8.7.52 NCA 108 Upper Thames Clay Vales (Ref 8.14) is described by the published study as a broad belt of open, gently undulating lowland farmland on predominantly clay soils. The published study states the NCA has *“contrasting landscapes, including enclosed pastures of the claylands with wet valleys, mixed farming, hedges, hedge trees and field trees and more settled, open, arable lands. Mature field oaks give a parkland feel in many places.”*

8.7.53 The NCA covers an extensive area of low-lying land which is dominated by watercourses, including the River Thames and its tributaries, whilst there are also lakes associated with mineral extraction areas. Collectively these watercourses and lakes form important areas for wildlife and recreation.

8.7.54 The NCA is noted by the published study for its major transport routes and patches of intensive industrial influence, including Didcot Power Station. There is little woodland cover, but hedgerows and mature field and hedgerow trees are a feature, and many watercourses are fringed with willow or poplar.

8.7.55 The published study identifies that potential growth of urban areas within the NCA may provide opportunities for creation of significant areas of accessible natural greenspace as part of comprehensive green infrastructure planning.

8.7.56 Stated NCA 108 statements of environmental opportunity (SEO) are to achieve sustainable growth and a secure environmental future.

8.7.57 NCA 108 SEO 4 is considered relevant to the Scheme and states: *“Realise sustainable development that contributes positively to sense of place and built heritage. Ensure adequate greenspace in association with all development and most importantly in growing settlements such as Aylesbury and Swindon. Create and manage greenspace to provide benefits for biodiversity, floodwater management, filtration of pollutants, tranquillity and recreation, and secure strategic access routes between town and country.”*

8.7.58 The landscape sensitivity of NCA 108 has been determined as set out in Appendix 8.4.

Oxfordshire Wildlife and Landscape Study, 2004

8.7.59 At a county level, OCC has prepared the Oxfordshire Wildlife and Landscape Study (OWLS) (Ref 8.15). The OWLS identifies LCTs for all of Oxfordshire, and LCAs within these LCTs.

8.7.60 As shown on Figure 8.10, the Site lies within the following LCT and LCA:

- Lowland Village Farmlands LCT is described as a variable, often large-scale farmed landscape closely associated with village settlements. Within the LCT is LCA WH/20 Sutton Courtenay.
 - LCA WH/20 Sutton Courtenay is characterised by the published study as *“medium to large-sized arable and grass fields. To the east of the village and north of Didcot Power Station, the landscape is dominated by an extensive area of mineral extraction and landfill sites, which are at varying stages of restoration. Fields are generally enclosed by a prominent network of tall, thick hawthorn and blackthorn hedges with a dense pattern of ash, willow, poplar, dead elm and oak trees, particularly bordering roads and country lanes. Roadside hedges are generally intact, but many internal field hedges are fragmented and gappy, particularly where they enclose arable land. There is also a significant number of tree-lined ditches with species such as crack willow, ash, poplar and dead elm. Small deciduous plantations and trees within villages are also characteristic.”*
- River Meadowlands LCT is described by the published study as a linear riverine landscape with a flat, well defined alluvial floodplain. It has pastoral character with meadows, wet and semi-improved pasture. Within the LCT is LCA WH/1 Lower River Thames.
 - LCA WH/1 Lower River Thames is characterised by the published study as *“small to medium-sized semi-improved grass fields and some arable farming, particularly around Radley. Hawthorn hedges are not a conspicuous feature, except in some of the less built-up areas. They are overgrown and gappy and, in places, replaced by fences. Gardens, and some parklands, come down to the river edge and are particularly noticeable adjacent to villages and other built-up areas. There is a continuous tree corridor that borders the river, consisting mainly of willows, poplars, alder and sycamore. There are also some pollarded willows bordering the river and ditches and, along the river, there are a few small mixed poplar and conifer plantations and ash and sycamore woods. More ornamental and exotic species such as weeping willows and conifers are associated with suburban gardens.”*
- Terrace Farmland LCT is described as by the published study as a flat, open, intensively farmed landscape overlying river gravel terraces. LCA WH/15 Culham is within the LCT.

- LCA WH/15 Culham which is described by the published study as *“dominated by medium to large-sized arable fields. Field boundaries are almost non-existent, although roadside hawthorn hedges have remained intact. The most prominent feature in the area is the linear strips of crack willows and poplars bordering watercourses. There are also occasional very small deciduous plantations.”*
 - Vale Farmland LCT is defined by the published study as a regularly shaped, arable fields enclosed by hawthorn hedges and hedgerow trees. A nucleated settlement pattern is also a characteristic feature of this landscape type. LCA WH/14 Clifton Hampden is within the LCT.
 - LCA WH/14 Clifton Hampden is described by the published study as *“a very intensively managed landscape characterised by large arable fields. The extensive grounds of Culham laboratory dominate the western part of the area. Hawthorn and dead elm hedges are often gappy and in poor condition. Scattered hedgerow trees and linear treebelts along ditches provide some structure to the landscape. There are a few small deciduous plantations scattered throughout.”*
 - Wooded Estatelands LCT is described by the published study as a wooded estate landscape characterised by arable farming and small villages with a strong vernacular character. LCA CR/15 Nuneham Courtenay is within the LCT.
 - LCA CR/15 Nuneham Courtenay is defined by the published study as *“dominated by large geometrically-shaped arable fields. Large blocks of ancient woodland and mixed plantations are prominent throughout the area. There are a few hedgerow trees, but they are not a significant landscape feature. Fields are enclosed by woodland and gappy thorn hedges. The parkland surrounding Nuneham Park is dominated by arable farming.”*
- 8.7.61 The OWLS identifies forces for landscape change, a landscape strategy and landscape management guidelines for each of the LCTs. Those relevant to the Site and the Scheme are set out in Appendix 8.3. The published guidance is based on the objective of ‘conserve and enhance’ key landscape features and minimise the visual impact of intrusive features.
- 8.7.62 The landscape sensitivity of the OWLS LCAs have been determined as set out in Appendix 8.4.
- South Oxfordshire District Council Landscape Assessment, 2017*
- 8.7.63 The SODC Landscape Assessment (SOLA) (Ref 8.16) is a district scale landscape character assessment.
- 8.7.64 As shown on Figure 8.11, the northern part of the Site is within LCA 2 Nuneham Courtenay Ridge.
- 8.7.65 The SOLA identifies LCTs within LCA 2, the following of which are within the Site:
- LCT 9 Institutions;
 - LCT 13 Open Farmed Hills and Valleys;
 - LCT 15 Parkland and Estate Farmland; and
 - LCT 17 Semi-Enclosed Farmed Hills and Valleys.
- 8.7.66 The following section summarises the key features of the LCA and LCT.
- 8.7.67 The landscape sensitivity of LCA 2 has been determined as set out in Appendix 8.4.

LCA 2 Nuneham Courtenay Ridge

- 8.7.68 LCA 2 Nuneham Courtenay Ridge comprises the southerly part of the low limestone hills of the mid-vale ridge, which appears as a prominent spur of higher land above the River Thames which bounds it to the west and south.
- 8.7.69 The area is described by the published study as *“a strong agricultural landscape, mostly comprised of arable land. Electricity pylons are a strong visual detractor in the area, particularly in the northern region (to the south of Oxford). Red kites are often seen in the skies above the area. The Wittenham Clumps are an omnipresent visual landmark across the area. The A4074 and A415 roads and the railway line are visual and aural detractors in the landscape.”*
- 8.7.70 The SOLA identifies forces for change in LCA 2, as well as landscape guidelines to protect, conserve and enhance the landscape qualities. Those relevant to the Site and the Scheme are set out in Appendix 8.3.

LCT 9 Institutions

- 8.7.71 The stated key characteristics of LCT 9 relevant to the assessment are:
- *“Landscaped setting with mature trees and semblance of parkland character but lacking its formal features; and*
 - *Dispersed complex of buildings, signs and land uses have an urbanising influence on rural context of the site.”*

LCT 13 Open Farmed Hills and Valleys

- 8.7.72 The stated key characteristics of LCT 13 relevant to the assessment are:
- *“Rolling plateau landform;*
 - *Large-scale farmland, mostly in arable cultivation;*
 - *Large fields, with rectilinear field boundaries, typical of parliamentary enclosures;*
 - *Weak structure of tightly clipped or gappy hedgerows, with few hedgerow trees;*
 - *Open, denuded and exposed character, with prominent skylines and hillsides and high intervisibility;*
 - *Distinctive elevated and expansive character on ridges and higher ground, with dominant sky and long views; and*
 - *Predominantly rural character but some localised intrusion of main roads, overhead power lines and built development.”*

LCT 15 Parkland and Estate Farmland

- 8.7.73 The stated key characteristics of LCT 15 relevant to the assessment are:
- *“Well-managed parkland character with formal features such as avenues and free-standing mature trees in pasture, clumps and blocks of woodland, exotic tree species, formal structures and boundary features;*
 - *Associated 'estate' landscape extending into a few areas beyond listed parkland and characterised by large blocks of woodland, open grassland and mature trees;*
 - *Rural and unspoilt character; and*

- *Generally enclosed character with strong landform, woodland and tree cover, low intervisibility but with some visually prominent hilltop and valleyside locations.”*

LCT 17 Semi-Enclosed Farmed Hills and Valleys

8.7.74 The stated key characteristics of LCT 17 relevant to the assessment are:

- *“As per LCT 13, though with a stronger structure of hedgerows and trees which provide clearer definition of field pattern;*
- *Occurs mostly in association with settlements (e.g. Marsh Baldon), where a smaller-scale field pattern and the hedgerow structure remain more intact;*
- *Predominantly intensive arable land use but some pockets of permanent pasture occur, particularly around settlements and on steeper hillsides;*
- *Predominantly rural character; and*
- *Landform and landscape structure create enclosure and reduce intervisibility.”*

Vale of White Horse District Council Landscape Character Assessment, 2017

8.7.75 The VoWHDC Landscape Character Assessment (Ref 8.17) characterises the landscape at a district scale.

8.7.76 This published study identifies LCT across the district which reflect the dominant influences on landscape character. These LCT are then sub-divided into LCA which provide a finer grain of detail.

8.7.77 The LCT and LCA do not include large areas of settlement. The published study also excludes areas on the edge of settlement which are committed to development and are likely to form part of the built-up areas in the future. The south of the Site between the A34 Milton Interchange and north of Didcot is therefore excluded from the study.

8.7.78 As shown on Figure 8.12, the remainder of the Site falls within the following LCT and LCA:

- LCT Lower Vale Farmland:
 - LCA VL6 North Didcot Lower Vale Farmland; and
 - LCA VL7 Appleford Lower Vale Farmland.
- LCT River Floodplain:
 - LCA RF9 Sutton Courtenay to Appleford Thames River Floodplain.

8.7.79 The VoWHDC Landscape Character Assessment identifies a landscape strategy, land management guidelines and built development guidelines for each LCT - those relevant to the Site and the Scheme are set out in Appendix 8.3.

8.7.80 The relevant features of the published LCA and LCT are summarised below. The landscape sensitivity of the LCT and LCA has been defined as set out in Appendix 8.4.

LCT Lower Vale Farmland

8.7.81 The Lower Vale Farmland LCT is described by the published study as a band of low-lying farmland through the centre of the District between the rising slopes of the Corallian Limestone Ridge to the north and North Wessex Downs to the south.

LCA VL6 North Didcot Lower Vale Farmland

8.7.82 The stated relevant key characteristics of LCA VL6 are:

- *“The Character Area is underlain by Gault Mudstone Formation bedrock geology, with sand and gravel superficial deposits;*
- *This is a flat, low lying landscape above the River Thames floodplain to the north. The landscape is marked by large scale gravel extraction at various stages of operation and restoration;*
- *The area includes large scale landscape influenced by intensive human intervention, with former and current gravel extraction evident, areas of restoration, lakes, mounding and landfill;*
- *Pylons cross the area;*
- *Restored areas include rough grassland, scrub, replacement hedges, and young woodland planting;*
- *There is limited settlement within the Character Area. However, the area adjoins the eastern edge of Sutton Courtenay, the western edge of Appleford and the northern edge of industrial areas to the north of Didcot;*
- *The area provides a physical and visual gap between Appleford and Sutton Courtenay, and physical separation to Didcot;*
- *Some smaller arable fields with boundary vegetation abut the eastern edge of Sutton Courtenay, providing some buffering between the settlement and quarry activity;*
- *The Cherwell Valley Railway Line between Didcot and Banbury forms the eastern boundary of the area, with the Appleford Sidings branching off the mainline into the Character Area;*
- *Main roads are limited to the B4016 within the northern part of the area;*
- *Public rights of way, including byways and bridleways cross the low lying landscape, providing pedestrian appreciation of the quarrying, with a connection to Appleford railway station in the northeast of the Character Area. Sustrans route 5 passes through the south of the area;*
- *The road bridge across the railway to the north of the station is a grade II listed structure;*
- *Views south are influenced by industrial areas to the north of Didcot, while to the north, there are views of the Corallian Limestone Ridge on the horizon; and*
- *Significant human influence prevents a sense of tranquillity or remoteness across the majority of the Character Area.”*

LCA VL7 Appleford Lower Vale Farmland

8.7.83 The stated relevant key characteristics of the LCA are:

- *“The Character Area is underlain by Gault Mudstone Formation bedrock geology, with sand and gravel superficial deposits;*
- *This is a low lying landscape above the River Thames floodplain to the north;*
- *The Character Area consist of large scale arable farmland, the majority of which is classified as grade 2 agricultural land;*
- *The area is contiguous with the wider rural landscape to the east beyond the District boundary;*

- *Hedges, such as hawthorn and blackthorn, are well maintained where they exist, and include occasional individual mature trees such as oak and ash, but there is no significant woodland;*
- *Moor Ditch flows north along the eastern boundary of the Character Area;*
- *The arable fields about the south-eastern edge of Appleford, and provide the setting to the eastern part of the settlement which is recorded to have medieval history. The Character Area also forms the wider southern and eastern setting to the grade II listed Church of St Peter and St Paul, along with a number of other listed buildings within Appleford;*
- *The Cherwell Valley Railway Line between Didcot and Banbury forms the western boundary of the area;*
- *Low density, ribbon development has spread along the B4016 to the south of Appleford, and includes a recreation ground and allotments situated within a strip of land between the B4016 and the railway;*
- *Associated tree cover separates this area from the wider open arable fields;*
- *The area forms part of the separation between Didcot and Appleford;*
- *The north-eastern portion of the Character Area is identified as the site of an ancient settlement;*
- *There are no public rights of way within the main body of the Character Area, however the area can be appreciated from the bridleway which runs adjacent to Moor Ditch; and*
- *The main body of the Character Area has an open aspect. Views south include industrial areas to the north of Didcot. The Corallian Limestone Ridge can be seen on the horizon to the north, and the Wittenham Clumps are visible in the distance to the east."*

LCT River Floodplain

- 8.7.84 The River Floodplain LCT is described by the published study as low-lying river terraces and valley bottoms following the courses of several rivers and streams that flow through the District.

LCA RF9 Sutton Courtenay to Appleford Thames River Floodplain

- 8.7.85 The stated relevant key characteristics of the LCA are:
- *"The LCA is underlain by Ampthill Clay Formation and Kimmeridge Clay Formation Mudstone, and Gault Formation Mudstone bedrock geology, with Alluvium Clay, Silt, Sand and Gravel superficial deposits;*
 - *The LCA includes parts of the River Thames which lie within the District boundary, and a narrow strip of flat river floodplain, which consists of the immediate waterside meadows, pasture and agricultural fields, and grounds of large houses, on the southern side of the Thames;*
 - *The Flood Zone extends further south beyond the LCA, however these areas are more characteristic of the wider quarried landscape of the Character Area to the south;*
 - *There is significant mature vegetation along the southern bank of the Thames, along most field boundaries, the railway, and tree groups within pasture to the north of Appleford;*

- *There is limited settlement within the area. However, the Character Area provides the setting to Sutton Courtenay and Appleford, including their listed buildings, and the Sutton Courtenay conservation area;*
- *Abingdon Road provides a link across the Thames and a connection to the Thames Path National Trail at Sutton Bridge near Culham Lock to the north, but there are few public rights of way within the LCA;*
- *A short length of the Cherwell Valley Railway Line cuts across the width of the LCA and crosses the Thames;*
- *Views across the LCA are limited by tree cover, although there are occasional views of waterborne activity along the Thames between gaps in vegetation; and*
- *Tree cover gives a degree of peace and tranquillity to the area, but nearby human influence, including filtered glimpses of adjacent settlement, reduce the sense of remoteness generally.”*

North Wessex Downs AONB Landscape Character Assessment, 2002

- 8.7.86 The Site is not within the North Wessex Downs AONB ('the AONB'), however part of the AONB falls within the study area. The North Wessex Downs Council of Partners has prepared an AONB Integrated Landscape Character Assessment (Ref 8.17). This assessment characterises the landscape into LCT, and then further sub-divides the LCT into smaller LCA.
- 8.7.87 As shown on Figure 8.13, the part of the AONB within the study area is the Downs Plain and Scarp LCT. A stated key issue for this LCT is the impact of development on the edge of the AONB such as at Didcot, resulting in visual impacts on the AONB.
- 8.7.88 A stated key management requirement for the LCT is the consideration of the impact of development outside the AONB on views from the higher ground across the LCT.
- 8.7.89 The LCT is sub-divided into the following LCA which are summarised in Appendix 8.3:
- LCA 5C Hendred Plain; and
 - LCA 5D Moreton Plain.
- 8.7.90 The landscape sensitivity of the LCA has been defined as set out in Appendix 8.4.

Local Landscape Character Areas

- 8.7.91 Following the detailed review of the above published landscape character assessments, Local Landscape Character Areas (LLCAs) have been identified to provide an additional and more proportionate scale of character assessment. The LLCAs are based on the prevalent characteristics of the landscape, informed by desk-study and fieldwork, and based on the existing LCT and LCA from the published assessments.
- 8.7.92 A total of 17 LLCAs have been identified, as shown on Figure 8.14. The LLCAs are described in Appendix 8.4 and summarised below as:
- LLCA 1: Harwell Downs, in the southern part of the study area, consisting of arable land around the village of Harwell;
 - LLCA 2: Harwell, covering land around the village of Harwell, between the North Wessex Downs AONB (to the south of the village) and the A34 (to the north of the village);

- LLCA 3: Didcot Farmland, consisting of arable land use located between the A34, the A4130 and Didcot;
- LLCA 4: Didcot Industrial, covering the industrial and commercial land uses at Milton Park, the A34 Milton Interchange, the former Didcot A Power Station, Didcot B Power Station and Southmead Industrial Estate;
- LLCA 5: Didcot, covering the settlement of Didcot, in the southern part of the study area;
- LLCA 6: Drayton Settled Farmland, covering the villages of Milton and Drayton and the intervening farmland in the western part of the study area;
- LLCA 7: River Settlements, covering covers the settlements of Culham and Sutton Courtenay which lie north and south of the River Thames respectively;
- LLCA 8: Thames Mineral Workings, covering the floodplain between Drayton and Culham;
- LLCA 9: Didcot Mineral Workings, covering the land between Sutton Courtenay, Appleford, the former Didcot A Power Station and Didcot B Power Station and the River Thames;
- LLCA 10: Vale Farmland, covering the land north of Didcot, between Appleford and Long Wittenham;
- LLCA 11: Wittenham Downs, covering the Wittenham Clumps and foothills of the AONB;
- LLCA 12: Thames Floodplain, covering the land between the River Thames and The A415;
- LLCA 13: Culham Farmland, covering the landscape west of Culham Science Centre, and predominantly north of the A415;
- LLCA 14: Culham Industrial, covering the Culham Science Centre and adjoining land uses;
- LLCA 15: Clifton Hampden, covering Clifton Hampton village and the adjoining land on the north bank of the River Thames;
- LLCA 16: Clifton Hampden Farmland, covering farmland north of Clifton Hampden; and
- LLCA 17: Nuneham Wooded Parkland, covering elevated land around Nuneham Courtenay, in the northern part of the study area.

8.7.93 With reference to Appendix 8.4, the sensitivity of these LLCA is assessed as ranging between negligible and very high.

Visual Amenity

8.7.94 To understand the visual context of the Site, desk-based study and fieldwork has been carried out across the study area between January 2020 and March 2021.

8.7.95 As set out in Section 8.6, ZTVs of the Scheme were prepared as part of the determination of the LVIA study area. In summary, the ZTVs indicated that the Scheme will be visible from mainly within approximately 2 km of the Site, along with areas of elevated land around the village of Harwell to the south and the Wittenham Clumps to the east (in the North Wessex Downs AONB), and Drayton to the west.

8.7.96 Fieldwork was undertaken to verify the visibility of the Site considering the influence of topography, buildings, and vegetation that are not captured within the ZTV. The

purpose of the fieldwork was to identify representative viewpoints to be taken forward for the visual assessment.

- 8.7.97 To account for seasonal variation between summer and winter when vegetation is not in leaf, fieldwork was carried out across both seasons to understand the differences in visibility throughout the year.
- 8.7.98 Representative viewpoints have been identified to represent the Scheme views experienced from a wide range of visual receptors, at various distances and directions from the Site.
- 8.7.99 A total of 48 representative viewpoints have been identified within the study area. As set out in Section 8.4, these representative viewpoints have been agreed with OCC as the determining authority, SODC as a local authority, and VoWHDC as a local authority.
- 8.7.100 The locations of the representative viewpoints (RV) are shown on Figure 8.15.
- 8.7.101 Baseline photography has been captured in summer and winter from each of the representative viewpoints, presented on Figures 8.16 to 8.63.
- 8.7.102 The following section provides a summary of the visual amenity of the study area, and views towards the Site from the selected RV.
- 8.7.103 The full narrative on the visual context and judgements on visual value, visual susceptibility and the sensitivity of visual receptors are set out in Appendix 8.4, which should be referred to when reading the below section.

Views from the A4130 – RV 1 to 5.

- 8.7.104 The A4130 forms a part of the Site, and therefore views from the A4130 are from within the Site boundary.
- 8.7.105 From along the A4130, views are generally contained by the mature hedgerows and vegetation that line the road, along with the Great Western Railway Mainline, which is on an embankment on the north side of the road. There are intermittent, brief and filtered views of the adjoining fields south of the road, but the views are generally featureless along the road corridor.

Views from south of the A4130 – RV 6 and 6a

- 8.7.106 RV 6 on Figure 8.21 presents a view north from PRow 243/1. The PRow is between dense hedgerows and belts of vegetation such that views out are only from intermittent locations such as field gates. Where there are views, they are generally across the adjoining field only, with views beyond screened by the mature hedgerows and vegetation in field boundaries. The chimney stacks of the Didcot B Power Station and other tall industrial buildings in Milton Park are notable features on the skyline in the view north from the eastern PRow. From the western PRow the chimney stacks are less apparent due to the slightly increased distance. The existing A4130 is not as visible as a result of the intervening vegetation, whilst the ground level of the Site is also not visible.

Views from Didcot – RV 7

- 8.7.107 RV 7 on Figure 8.22 presents a view north-west from the edge of the recent Great Western Park development. The winter and summer photographs demonstrate that from this slightly elevated position, the Site is visible in the mid-ground of the view

between the receptor, Milton Park and the Didcot B Power Station site. There are currently construction compounds and construction activity in the foreground of the view, and the land in the foreground is allocated for development as part of the Valley Park scheme. The vegetation belts along the south side of the A4130 are visible, with the tall warehouses and industrial buildings at Milton Park on the skyline beyond. The chimney stacks of the Didcot B Power Station are prominent features across the skyline.

Views from around the former Didcot A and Didcot B Power Station – RV 8

- 8.7.108 From public locations around the former Didcot A Power Station and Milton Park, the Great Western Railway Mainline forms a visual barrier to the A4130 section of the Site to the south. The only public views of the Site are from PRoW 373/24 (part of the local 'Hanson Way' route) along Didcot B northern boundary. The route appears to be a well-used cycleway as well as footway.

Views from Didcot Industrial Estate – RV 9

- 8.7.109 RV 9 on Figure 8.24 presents a view north from within Didcot Industrial Estate towards the northern roundabout access from the A4130. The summer and winter photographs demonstrate the curtailed nature of the views, which are of industrial and commercial buildings, the highway, and amenity planting within the industrial estate. The roundabout and adjoining vegetation that form the background of the view are within the Site.

Views from south Appleford – RV 10, 10a, 10b, 10c and 11

- 8.7.110 Public views of the Site from the south of Appleford are from the Appleford Crossing, and from PRoW 106/3 and PRoW 106/4. In views from Main Road, the intervening residential properties and vegetation west of the road screen views of the Site.
- 8.7.111 There are close residential views from Appleford Crossing Cottage (Railway Cottages) and from Hill Farm, which are private residence. There are also views from private properties on the west side of Main Road to the north of the level crossing, where the angle of the Appleford Railway Siding railway may allow an oblique view of the Site between the belts of mature vegetation.
- 8.7.112 The availability of public viewpoints in this area is limited overall.

Views from Moor Ditch RV 12 and 13

- 8.7.113 The Moor Ditch is lined by a PRoW between Didcot and Long Wittenham to the east of Appleford which is part of NCN Route 5. Views towards the Site from the Moor Ditch are intermittent, as the route is generally lined by mature vegetation, and the Site is at an oblique angle to the west of the route. There are short sections of path where the Site is visible around Appleford.

Views West from Appleford – RV 14, 15 and 15a

- 8.7.114 RV 14 on Figure 8.29 presents a view west from an open location at Appleford Recreation Ground in Appleford. The photograph demonstrates that in both summer and winter the mature belt of vegetation on the western side of the railway screens views towards the Site and the former landfill site in the west.
- 8.7.115 RV 15 on Figure 8.30 presents a view west from the B4016 as it exits the village of Appleford, where PRoW 106/8 joins the road. The photographs demonstrate that since the summer photography was completed in September 2020, a tree alongside

the road has been felled prior to the winter photography in January 2021. The photographs show that in both summer and winter the tree line on the south side of the road screens views to the south, but there are more open views to the north. A low engineered bund around the former minerals working sites to the north channel's views along the road in this location, and partially screens views to the north when travelling by road. High voltage pylons and power lines punctuate the skyline across the view. The Site is visible at the western end of the B4016, and partially visible across the floodplain to the north.

Views from B4016 – RV 16

- 8.7.116 RV 16 on Figure 8.31 presents a view from the B4016 and the former alignment of PRoW 373/12. The summer and winter photographs demonstrate there is a limited change in the characteristics of the view between seasons. The foreground is made up of the road and earthworks relating to construction sites and former mineral workings sites. The tree line alongside the River Thames is visible in the background to the north. The Wittenham Clumps are a distinctive feature on the skyline to the east. The Site is partially visible to the east beyond the intervening earthworks, extending north towards the River Thames.

Views from the Thames Path National Trail – RV 17 to 22

- 8.7.117 RV 17 on Figure 8.32 presents a view east from the bridge crossing at the Culham Lock, adjoining the Thames Path National Trail. The photographs demonstrate that in both summer and winter vegetation alongside the river screens the Site from this distance.
- 8.7.118 RV 18 on Figure 8.33 is from a point heading east where the Thames Path emerges from woodland and views are more open along the east, and where the Site becomes visible in the mid ground of the view. The view is channelled along the route by the vegetation lining the River Thames and the field boundary to the north, somewhat framing the Wittenham Clumps on the skyline in the distance. High voltage pylons and power lines are a prominent vertical feature across the view.
- 8.7.119 RV 19 on Figure 8.34 is a close view of the Site looking east from along the Thames Path, with the Site crossing the field in the foreground of the view. The photograph demonstrates that there are direct views of the Site, and that views are currently contained to the field which the footpath is crossing as a result of vegetation around the field boundary. The Wittenham Clumps are not visible on the skyline in this location due to the slightly lower elevation compared to RV 18.
- 8.7.120 RV 20 on Figure 8.35 is a close view of the Site looking west from along the Thames Path, with the Site crossing the field in the foreground of the view. The photographs demonstrate that there are direct views of the Site. The rising landform to the north is apparent. High voltage pylons and power lines are a prominent vertical feature in the view.
- 8.7.121 RV 21 on Figure 8.36 presents a view looking west from the Thames Path, close to the where the Site first becomes visible. The photographs demonstrate some difference between the summer and winter views, with intervening vegetation providing slightly greater screening of the Site in the summer compared to the winter view. In each view the Site is partially visible in the background of the view. High voltage pylons and power lines are a prominent vertical feature in the view.
- 8.7.122 RV 22 on Figure 8.37 is looking west from close to the Cherwell Valley Railway Line and demonstrates that from this distance, in both the summer and winter views, the Site is not visible as a result of intervening vegetation.

Views from west of Culham Science Centre - RV 23 to 25

- 8.7.123 RV 23 on Figure 8.38 presents a view east along the A415 from a point just west of the Site. The photographs demonstrate that the Site is visible in the mid-ground of the view in both winter and summer. The low hedgerows alongside the road allow views across the fields to the north, with partial views across the fields to the south. The buildings of CSC are more apparent in the winter view than in summer but are visible in each. High voltage pylons and power lines are a prominent vertical feature in the view.
- 8.7.124 People at the Europa School (receptor 23a) have partial views out across the fields to the east, with a similar but slightly more distant view as shown by RV 23.
- 8.7.125 RV 24 on Figure 8.39 presents a view west along the A415 from a point just east of the Site. The view is similar in character to RV 23, with the photographs demonstrating that the Site is visible in the mid-ground of the view in both winter and summer. The low hedgerows alongside the road allow views across the fields to the north, with partial views across the fields to the south. High voltage pylons and power lines are a prominent vertical feature in the view.
- 8.7.126 Zouch Farm (receptor 24a) is a private property and has not been visited, however views from the property are likely to be similar in character as those from RV 24, but that the receptor is further from the Site and partially enclosed by vegetation.
- 8.7.127 RV 25 on Figure 8.40 presents a view south from PRow 183/4 towards the Site at the A415. The photographs demonstrate there is limited change to the view between winter and summer, and that the view has an open character due to the large-scale field pattern, plateau topography and lack of vegetation. The Site is visible along the A415 to the south, with traffic along the road a dynamic feature. High voltage pylons and power lines are a prominent vertical feature in the view, whilst Didcot Power Station and the Wittenham Clumps are visible on the skyline in the background of the view.

Views from the entrance to Culham Science Centre – RV 26 to 29

- 8.7.128 RV 26 on Figure 8.41 presents a view looking east from Station Road parallel to the north side of the A415. The photographs demonstrate that the view has a somewhat open character with little vegetation cover, and therefore there is limited difference between the winter and summer view. The Site is visible across the foreground and middle ground of the view. The view comprises a modified landscape, evident by the steep embankment the A415 is on to the south, swales, security fencing and lighting columns.
- 8.7.129 Residents east of Culham Station (receptor 26a) have more filtered views in this direction as a result of vegetation around their property boundaries, and other intervening vegetation between the properties and the Site. The properties have not been visited so it is assumed there are filtered views of the Site through these belts of vegetation.
- 8.7.130 RV 27 on Figure 8.42 presents a view from the footway/cycleway along the A415 in front of residents at Fullamoor. The photographs demonstrate that the foreground of the view comprises the A415 and highway infrastructure including lighting and the bus stops. The view is curtailed by trees and shrubs in the entrance to CSC, such that in both the summer and winter views there is limited visibility of the buildings and infrastructure within the site. RV 27 is within the Site and as such the Site takes up the full extent of the view. There are hedgerows on the south side of the A415 along

the boundary with Fullamoor, but likely to be upper-storey residential views across the area.

8.7.131 RV 28 on Figure 8.43 presents a view looking west along the A415 close to the entrance to CSC. The photographs demonstrate the linear nature of views along the road, with the entrance to CSC appearing to be manicured. The Site aligns to the A415 and the entrance area to CSC and is therefore visible across much of the view.

8.7.132 RV 29 on Figure 8.44 presents a view west along the A415. The photographs demonstrate that in winter the A415 is slightly less enclosed when vegetation is in leaf, but overall visibility towards the Site is unchanged. The view is contained to the road corridor and comprises the road and cycleway enclosed by vegetation. Residential properties north and south of the road in this location are enclosed by vegetation such that they do not have views of the Site.

Views from south of the A415 at Culham Science Centre – RV 30

8.7.133 RV 30 on Figure 8.45 presents a view north from PRoW 171/15, south-west of Clifton Hampden. The view demonstrates that the rising landform to the north in combination with the intervening vegetation screen views of the Site from this area. In winter when the vegetation is not in leaf there are slightly more open views to the north, but the Site remains not visible.

Views from around Clifton Hampden – RV 31 to 39A

8.7.134 RV 31 on Figure 8.46 presents a view looking east towards Clifton Hampden from PRoW 171/10 which is on the eastern edge of CSC. The photographs demonstrate that in summer the tree line between the CSC and Clifton Hampden screens views towards the village, and that the view is contained to the field adjoining the footpath. In winter there are filtered views through the tree line towards Clifton Hampden, but the village is still largely screened. The Site is visible across the field in the foreground.

8.7.135 RV 32 on Figure 8.47 presents a view north towards the ridgeline at Nuneham Courtenay from PRoW 171/10 west of Clifton Hampden. The view is taken from a gap in a tree line used as a field access, with other views north from this PRoW screened by the tree line. The photographs demonstrate the view is across gently undulating fields towards the ridgeline. The view is enclosed by mature blocks of woodland and vegetation. The Site is visible across the field in the mid-ground of the view.

8.7.136 RV 33 on Figure 8.48 presents a view north-west from the western edge of Clifton Hampden at PRoW 171/2. The photographs demonstrate that the view is curtailed to the field adjoining the village edge, with some more filtered views through the adjoining tree lines and vegetation in winter. The Site is screened by the vegetation in the view.

8.7.137 RV 34 on Figure 8.49 presents a view towards the northern edge of Clifton Hampden from PRoW 171/6. The photographs demonstrate that the view is curtailed by vegetation around the edge of Clifton Hampden and in the field boundaries, such that the view is principally of the field in the foreground. There are several residential properties visible amongst the treeline around the village edge but limited other evidence of settlement. The Site is visible across the field in the foreground of the view.

8.7.138 RV 35 on Figure 8.50 presents a view east from PRoW 171/16, part of the Oxford Greenbelt Way. The photographs demonstrate that in summer, vegetation alongside

the footpath screen or heavily filter views towards the Site, but that in winter there are some more open views out from the route. Security fencing is apparent in the view.

8.7.139 RV 36 on Figure 8.51 presents a view north from PRoW 171/3 on the northern edge of Clifton Hampden. The photographs demonstrate that the view is unspoilt with no visible settlement or infrastructure, with a simple character to the view of open fields and tree lines. In winter there are more filtered views through treelines, but the characteristics of the view are unchanged. The Site is visible across the foreground of the view.

8.7.140 RV 37 on Figure 8.52 presents a view north from PRoW 171/5 to the north of Clifton Hampden. The photographs demonstrate that the B4015 is visible to the east, with an open boundary between the road and the field. Views north are curtailed by vegetation in both summer and winter, with views west screened in summer but with some views through the vegetation in winter. The Site is visible across the foreground of the view.

8.7.141 RV 38 on Figure 8.53 presents a view south from PRoW 171/3, which connects Clifton Hampden with Nuneham Courtenay. The footpath is on elevated land in relation to the Clifton Hampden and the Site and continues to rise to the north. As the footpath heads north along the field boundary, it crosses a subtle crest in the landform such that from closer to the boundary with Nuneham Courtenay the landform within the field screens views of the lower-lying Site. The photographs demonstrate that the view towards the Site and the edge of Clifton Hampden is open, with partial views of buildings along the edge of the village. The spire of St. Michael and All Angels Church in Clifton Hampden is partially visible above the treeline in the direction of the village from more elevated positions along the footpath to the north, with the North Wessex Downs AONB visible in the distant background. There are partial views of buildings at CSC from intermittent locations along the footpath. The Site is visible across the mid-ground of the view.

8.7.142 RV 39 on Figure 8.54 presents a view north-west from PRoW 171/4, which is east of the village of Clifton Hampden. The photographs demonstrate there are partial views of the residential edge of the village to the west, and of high voltage pylons on the distant skyline, but otherwise the view is of the large-scale field in the foreground and vegetated skyline. The B4015 is partially visible along the field boundary, and the Site is partially visible in the same direction.

Views from Nuneham Courtenay – RV 40

8.7.143 RV 40 on Figure 8.55 presents a view south from PRoW 317/2, which is close to the high point within the Nuneham Courtenay landscape. The photographs demonstrate that in both summer and winter the extent of mature vegetation along the skyline screens views towards the Site.

Views from Long Wittenham – RV 41

8.7.144 RV 41 on Figure 8.56 presents a view from PRoW 287/6 on the edge of Long Wittenham. The photographs demonstrate that in both summer and winter there are partial views of Milton Park, Didcot B Power Station, and the upper elevation of the working landfill south-west of Appleford. High voltage pylons and power lines are visible across the skyline in both the foreground and background of the view. The Site is not visible as a result of intervening landform and vegetation.

Views from Milton and Sutton Courtenay – RV 42

- 8.7.145 RV 42 on Figure 8.57 presents the view south-east from PRoW 299/1 between Milton and Sutton Courtenay. The photographs demonstrate that in both summer and winter there are open views towards Milton Park and the Didcot B Power Station. The skyline intermittently comprises tall industrial buildings, chimney stacks, and high voltage pylons and power lines. The North Wessex Downs AONB is partially visible in the distant background. The ground-level of the Site is not visible as a result of the intervening buildings and vegetation.

Views from Drayton – RV 43

- 8.7.146 RV 43 on Figure 8.58 demonstrates that from this distance and elevation in relation to the Site, intervening vegetation screens the Site. Chimney stacks at the Didcot B Power Station are visible on the skyline, along with high voltage pylons and power lines.

Views from Harwell and Milton Hill – RV 44 and 45

- 8.7.147 RV 44 on Figure 8.59 presents a view north from the north-western residential edge of Harwell. The summer and winter photographs demonstrate the screening effect of the mature belts of poplar, such that the Site is not visible from the village.
- 8.7.148 RV 45 on Figure 8.60 presents a view north from PRoW 243/7 to the west of Harwell. The photographs demonstrate that in winter there are partial, heavily filtered views of the Didcot B Power Station through the intervening vegetation, but that in summer the vegetation screens views of the power station and landscape around the Site. The Site is not visible from this area.

Views from the North Wessex Downs AONB – RV 46 to 48

- 8.7.149 RV 46 on Figure 8.61 presents a view north from PRoW 243/16, south of Harwell in the North Wessex Downs AONB. The view takes in the setting of the AONB. The photographs demonstrate the panoramic, far-reaching character of the view, which includes prominent features such as the Didcot B Power Station, and Wittenham Clumps. The CSC can be seen in the background of the view. The Site is not discernible in the view as a result of distance and the scale of existing development across the view.
- 8.7.150 RV 47 on Figure 8.62 presents a view north from a ridgeline east of Didcot, just outside the North Wessex Downs AONB. The photographs demonstrate that in both summer and winter there are panoramic and far-reaching views across the study area from this location. The view takes in widespread development in the setting of the AONB, including Milton Park and the Didcot B Power Station, the working landfill site south of Appleford, and CSC. The Site is partially visible beyond intervening vegetation in the landscape between Appleford and Didcot, but north of Appleford the Site is not discernible as a result of distance and intervening features.
- 8.7.151 RV 48 on Figure 8.63 presents a view from the Wittenham Clumps in the North Wessex Downs AONB, a popular viewpoint and visitor destination. The photographs demonstrate the panoramic, far-reaching views. The Didcot B Power Station is a prominent feature in the view. The Site is partially visible in the background of the view but is not readily discernible as a result of distance and intervening vegetation.

Character of the Night Sky

- 8.7.152 The LVIA includes a qualitative assessment of the existing lighting and character of the night sky, informed by desk-study and fieldwork.
- 8.7.153 With reference to Figure 8.64, England's Light Pollution and Dark Skies, published online by CPRE, indicates the level of radiance (night lights) shining up into the night sky. These have been categorised into colour bands by CPRE to distinguish between different light levels, such that the brightest light levels are represented by the orange, pink, red and brown colours, and the darkest light levels are represented by the green, and light and dark blues.
- 8.7.154 The dark sky mapping indicates the varying levels of light pollution within the study area, with intensive lighting across Didcot, Milton Park, the Didcot B Power Station and CSC contrasting with darker skies in the east of the study area at the Wittenham Clumps and east of Clifton Hampden. The remainder of the study area is in areas of increased levels of radiance relating to areas of settlement, roads, and other infrastructure.
- 8.7.155 The Site is located principally within areas of increased light radiance, with only a small part of the Site north of Clifton Hampden falling within an area of dark skies, and the landscape around the River Thames being in an area of moderate-to-low light radiance.
- 8.7.156 Fieldwork was undertaken in March 2021 to gain a more localised understanding of lighting within the study area. This involved working across the study area from sunset through to night, stopping at intermittent locations to review and identify specific sources of light and the impact of light pollution.
- 8.7.157 Night-time photography has been captured from six viewpoints close to or within the Site as a reference and record of baseline lighting in the area. In addition, night-time photography has been captured from the Wittenham Clumps viewpoint in the North Wessex Downs AONB as a reference for the existing lighting in the setting of the AONB, and as a popular viewpoint for experiencing sunsets and night skies.
- 8.7.158 With reference to Figure 8.15, the viewpoints where night-time photography has been captured are described below:
- RV 7 - View-north-west from Didcot at Gary O'Donnell Drive: Figure 8.65 presents the night-time view from RV 7 and demonstrates the extent of lighting and light pollution around Milton Park and the Didcot B Power Station, such that it is not a dark landscape. The A4130 is principally unlit, apart from at junctions such as the junction between the A4130 and Sir Frank Williams Avenue which can be seen in the right hand side of the photograph, and the approach to the A34 Milton Interchange (not in photograph). The residential areas in the west and north of Didcot are also street lit, although not seen in the photograph, and are a notable source of light pollution in the area. Car headlights and taillights are visible along the A4130.
 - RV 12 - View west from Moor Ditch south of the B4016: Figure 8.66 presents the night-time view from RV 12, and demonstrates that whilst the landscape is predominantly dark, there are distinct areas of sky glow towards Didcot and towards Milton Park. The sky glow is particularly identifiable beyond the silhouette of the working landfill site. There are also direct views of lighting at the Didcot B Power Station to the left of the view, and at the Appleford Crossing where a floodlight lights up the crossing. There are partial views of other light sources along the B4016 Main Road towards Appleford, but this road is not street lit. Car headlights and taillights are apparent along the B4016.

- RV 15 - View west from the northern end of Appleford at the B4016: Figure 8.67 presents the night-time view from RV 15 and demonstrates that the landscape west of Appleford towards the River Thames is essentially dark with very few visible sources of light, apart from a light sources on the north side of the River Thames. There is sky glow evident in the direction of Abingdon beyond the study area to the north. Car taillights and headlights are visible along the existing B4016, and partially of the A415 on the north side of the River Thames in the distance.
- RV 25 - View south from PRoW 183/4: Figure 8.68 presents the night-time view from RV 25 and demonstrates that the landscape here includes widespread light sources, and areas of sky glow such that it is not a dark landscape. The CSC in the left of the view includes lights on buildings across the site, and distinct glare and sky glow. There are street lights along the A415 in the left of the view around the junction with CSC, and lighting across the background of the view at Didcot and the Didcot B Power Station. The Europa School in the right of the view (not in photograph) is also lit up. Car headlights and taillights are visible along the A415.
- RV 27 - View north and west from the A415 at Fullamoor: Figure 8.69 presents the night-time view from RV 27 and demonstrates that there is lighting across the foreground of the view along the A415, and the entrance of the CSC. Lighting within the CSC is heavily filtered by vegetation, with some sky glow evident. Car headlights and taillights are visible along the A415.
- RV 36 - View north and west from PRoW 171/3 (footpath), on the northern edge of Clifton Hampden: Figure 8.70 presents the night-time view from RV 36, which demonstrates that the landscape north of Clifton Hampden is essentially dark, with no visible sources of light. There is subtle sky glow visible to the north from either Abingdon or Oxford, and from CSC, but it is a predominantly dark area. Lighting at CSC is heavily filtered by the intervening vegetation. There is some light spill from the residential properties around the edge of the village, but this is limited. Clifton Hampden is a very dark village, with no street lighting apart from a few subtle streetlights and traffic lights at the junction between the A415 and B415.
- RV 48 - View from the Wittenham Clumps in the North Wessex Downs AONB: Figure 8.71 presents the night-time view from RV 48, which demonstrates that from the Wittenham Clumps and from the AONB there is widespread lighting across the view relating to settlement and infrastructure. The areas of lighting are principally concentrated away from the AONB, such that foreground and mid-ground of the view is visibly darker. Prominent areas of lighting include Didcot, the FCC site, the Hanson site, and CSC. Long Wittenham is street lit which makes it an identifiable settlement pattern. There are distinct areas of sky glow towards Didcot, Abingdon and Oxford.

8.7.159 In summary, with reference to the Institute of Lighting Professionals ‘*Guidance notes for the reduction of obtrusive light*’ (Ref 8.18), the southern part of the Site is considered to be between Zones E2 and E4 due to the varied land uses and existing sources of light. The remainder of the Site is considered to be Zone E2 Rural due to the land use and smaller scale and localised areas of lighting. The more sensitive areas of the Site to lighting have been identified as the River Thames crossing, and the landscape north and north-east of Clifton Hampden.

8.7.160 In the wider study area, the landscape to the east of the Site, on the fringe of the North Wessex Downs AONB is Zone E1 Natural. Here there are dark skies and limited lighting in the close setting of the AONB, but more extensive lighting and sky glow in the distance across the Thames vale such that it is not a wholly dark landscape as per the category E0.

8.7.161 At the local landscape character area, Table 8.10 sets out the assessed lighting zones.

Table 8.10: Local Landscape Character Lighting Zones

Local Landscape Character Area	Lighting Zone	Local Landscape Character Area	Lighting Zone
LLCA 1 Harwell Downs	E2	LLCA 10 Vale Farmland	E2
LLCA 2 Harwell	E2	LLCA 11 Wittenham Downs	E2
LLCA 3 Didcot Farmland	E2	LLCA 12 Thames Floodplain	E2
LLCA 4 Didcot Industrial	E3	LLCA 13 Culham Farmland	E2
LLCA 5 Didcot	E4	LLCA 14 Culham Industrial	E3
LLCA 6 Drayton Settled Farmland	E3	LLCA 15 Clifton Hampden	E2
LLCA 7 River Settlements	E3	LLCA 16 Clifton Hampden Farmland	E2
LLCA 8 Thames Mineral Workings	E3	LLCA 17 Nuneham Wooded Parkland	E2
LLCA 9 Didcot Mineral Workings	E2		

8.7.162 In relation to the published landscape character areas, which cover a larger geographic area, the lighting zones are assessed as ranging between E2 and E3.

Summary of Landscape and Visual Receptors

8.7.163 The landscape and visual baseline of the study area has been described for the study area.

8.7.164 Landscape receptors have been identified from published studies at a national, county and district level, and from the AONB designated landscape. In addition, local landscape receptors have been identified, informed by the published studies, desk study and fieldwork.

8.7.165 Table 8.11 provides a summary of the landscape receptors and their defined sensitivity, with reference to Appendix 8.4.

Table 8.11: Summary of Landscape Receptors

Landscape Receptor	Sensitivity
Natural England National Character Areas	
NCA 108: Upper Thames Clay Vales	Medium
Oxfordshire Wildlife and Landscape Study LCAs	
LCA WH/20 Sutton Courtenay	Medium
LCA WH/1 Lower River Thames	Medium
LCA WH/15 Culham	Medium
LCA WH/14 Clifton Hampden	Low
LCA CR/15 Nuneham Courtenay	High

Landscape Receptor	Sensitivity
South Oxfordshire Landscape Assessment and LCAs	
LCA 2 Nuneham Courtenay	Medium
Vale of White Horse Landscape Character Assessment and LCAs	
LCA VL6 North Didcot Lower Vale Farmland	Low
LCA VL7 Appleford Lower Vale Farmland	Low
LCA RF9 Sutton Courtenay to Appleford Thames River Floodplain	Medium
North Wessex Downs AONB Integrated Landscape Character Assessment LCAs	
LCA 5C Hendred Plain	Very High
LCA 5D Moreton Plain	Very High
AECOM defined Local Landscape Character Areas LLCs	
The Site	Medium
LLCA 1 Harwell Downs	High
LLCA 2 Harwell	Medium
LLCA 3 Didcot Farmland	Low
LLCA 4 Didcot Industrial	Negligible
LLCA 5 Didcot	Negligible
LLCA 6 Drayton Settled Farmland	Low
LLCA 7 River Settlements	High
LLCA 8 Thames Mineral Workings	Medium
LLCA 9 Didcot Mineral Workings	Low
LLCA 10 Vale Farmland	Medium
LLCA 11 Wittenham Downs	Very High
LLCA 12 Thames Floodplain	Medium
LLCA 13 Culham Farmland	Low
LLCA 14 Culham Industrial	Negligible
LLCA 15 Clifton Hampden	High
LLCA 16 Clifton Hampden Farmland	Medium
LLCA 17 Nuneham Wooded Parkland	High

8.7.166 Visual receptors have been identified from a combination of desk study and fieldwork within the study area.

8.7.167 Representative viewpoints have been identified to represent the views experienced from a wide range of visual receptors, at various distances and directions from the Site.

8.7.168 Table 8.12 provides a summary of the visual receptors and their sensitivity, with reference to Appendix 8.4.

Table 8.12: Summary of Visual Receptors

Visual Receptor	Sensitivity
Views from the A4130	
Representative Viewpoint 1	
1 - Road users	Negligible
Representative Viewpoint 2	
2 - Road users	Negligible
Representative Viewpoint 3	
3 - Road users	Negligible
Representative Viewpoint 4	
4 - Road users	Negligible
Representative Viewpoint 5	
5 - Road users	Negligible
Views from south of the A4130	
Representative Viewpoint 6	
6 - Recreational users	Low
Views from Didcot	
Representative Viewpoint 7	
7 – Residents	Medium
Views from around the former Didcot A and Didcot B Power Station	
Representative Viewpoint 8	
8 - Recreational users	Medium
Views from Didcot Industrial Estate	
Representative Viewpoint 9	
9 - People at work	Negligible

Visual Receptor	Sensitivity
Views from south Appleford	
Representative Viewpoint 10	
10 - Recreational users	Low
10a - Residents	Medium
10b - Residents	Medium
10c - Rail users	Negligible
Representative Viewpoint 11	
11 - Recreational users	Low
Views from Moor Ditch	
Representative Viewpoint 12	
12 - Recreational users	Medium
12a - Road users	Low
Representative Viewpoint 13	
13 - Recreational users	Medium
Views from Appleford	
Representative Viewpoint 14	
14 - Residents	Medium
Representative Viewpoint 15	
15 - Road users	Low
15a - Residents	Medium
Views from B4016	
Representative Viewpoint 16	
16 - Road users	Medium
Views from Thames Path National Trail	
Representative Viewpoint 17	
17 - Recreational users	High
Representative Viewpoint 18	
18 - Recreational users	High

Visual Receptor	Sensitivity
Representative Viewpoint 19	
19 - Recreational users	High
Representative Viewpoint 20	
20 - Recreational users	High
Representative Viewpoint 21	
21 - Recreational users	High
Representative Viewpoint 22	
22 - Recreational users	High
Views from west of Culham Science Centre	
Representative Viewpoint 23	
23 - Road users	Low
23a - People at school	Low
Representative Viewpoint 24	
24 - Road users	Low
24a - Residents	Medium
Representative Viewpoint 25	
25 - Residents	Medium
Views from the entrance to Culham Science Centre	
Representative Viewpoint 26	
26 - Road users	Low
26a - Residents	Medium
Representative Viewpoint 27	
27 - Residents	Medium
Representative Viewpoint 28	
28 - Road users	Low
Representative Viewpoint 29	
29 - Road users	Low

Visual Receptor	Sensitivity
Views from south of the A415 at Culham Science Centre	
Representative Viewpoint 30	
30 - Recreational users	Medium
Views from around Clifton Hampden	
Representative Viewpoint 31	
31 - Recreational users	Medium
Representative Viewpoint 32	
32 - Recreational users	Medium
Representative Viewpoint 33	
33 - Residents	Medium
Representative Viewpoint 34	
34 - Recreational users	Medium
Representative Viewpoint 35	
35 - Recreational users	Medium
Representative Viewpoint 36	
36 - Recreational users	Medium
36a - Residents	Medium
Representative Viewpoint 37	
37 - Recreational users	Medium
Representative Viewpoint 38	
38 - Recreational users	Medium
Representative Viewpoint 39	
39 - Recreational users	Medium
39a - Residents	Medium
Views from Nuneham Courtenay	
Representative Viewpoint 40	
40 - Recreational users	Medium

Visual Receptor	Sensitivity
Views from Long Wittenham	
Representative Viewpoint 41	
41 - Residents	Medium
Views from Milton and Sutton Courtenay	
Representative Viewpoint 42	
42 - Residents	Medium
Views from Drayton	
Representative Viewpoint 43	
43 - Residents	Medium
Views from Harwell and Milton Hill	
Representative Viewpoint 44	
44 - Residents	Medium
Representative Viewpoint 45	
45 - Recreational users	Medium
Views from the North Wessex Downs AONB	
Representative Viewpoint 46	
46 - Recreational users	High
Representative Viewpoint 47	
47 - Recreational users	High
Representative Viewpoint 48	
48 - Recreational users	Very High

8.8 Design Mitigation and Enhancement Measures

Embedded Mitigation

8.8.1 As set out in ES Chapter 2: The Scheme, the Scheme consists of four separate but interdependent highway schemes, namely:

- A4130 Widening;
- Didcot Science Bridge;
- Didcot to Culham River Crossing; and
- Clifton Hampden Bypass.

8.8.2 Embedded mitigation is defined within DMRB LA104 as “*design measures which are integrated into a project for the purpose of minimising environmental effects*”. The Scheme has been designed, as far as possible, to avoid and minimise impacts and landscape and visual effects through the process of design-development (refer to Chapter 3: Assessment of Alternatives) considering good design principles. The following section reports the essential mitigation required in addition to embedded mitigation to reduce and offset likely significant adverse environmental effects.

8.8.3 The overarching embedded landscape and visual mitigation measures for the Scheme are:

- Alignment of the Scheme as a principally off-line link road between Didcot and Culham, and as a bypass to Clifton Hampden, to retain the existing local rural roads and reduce traffic through the nearby settlements of Sutton Courtenay, Appleford, Culham, Long Wittenham and Clifton Hampden, such that there is an improvement to tranquillity within the settlements;
- Provision of new high-quality cycleway and footway which for the majority of the scheme length are segregated, providing a new sustainable route connecting Milton Park and CSC, with connections to nearby villages and emerging/allocated housing and employment developments. The intention of the cycleway and footway is to improve connectivity, recreational opportunities and reduce severance in the landscape, whilst promoting sustainable transport; and
- Limiting the height of the proposed lighting of the new cycleway and footway to 5 m as well as the junctions and roundabouts between the River Thames crossing to 10 m. The lighting will use low-energy LED (light-emitting diode) lighting that has limited light spill or glare, to reduce the impact of lighting on views and the character of the night sky, as well as to respond positively to ecological matters at the River Thames crossing.

8.8.4 The Scheme landscape masterplans are presented on Figure 8.72a to 8.72s, the sections below outlines detailed embedded mitigation measures integrated into the Scheme design. Reference should be made to the Arboricultural Impact Assessment, Tree Protection Plans (sheet 2 to 7) for specific detail relating to hedge and tree removal.

A4130 Widening

8.8.5 The following specific measures have been incorporated into the Scheme design with regard to the A4130 Widening:

- A fair section of the existing ditch and hedgerow on the south side of the A4130 to the west of Didcot has been retained within the proposed central reservation (refer to Arboricultural Impact Assessment and Tree Protection Plans sheet 2 to 7 for more detail), with the westbound carriageway constructed off-line to the south to maintain landscape structure, integrate the road, and provide screening of eastbound traffic. For pedestrians and cyclists this also provides separation between the live carriageways;
- The proposed landscape planting seeks to integrate the A4130 Widening by re-planting trees and shrubs alongside the south side of the new westbound carriageway. This will delineate segregation between NMUs and vehicles, restore vegetation patterns and strengthen the landscape structure where practicable; and
- There are strategic linear planting blocks of trees and shrubs within the landscape design, which once established will help screen both infrastructure and traffic, particularly around the junctions.

Didcot Science Bridge

8.8.6 The following specific measures have been incorporated into the Scheme design with regard to the Didcot Science Bridge:

- The southern embankment of the Didcot Science Bridge has been designed to allow for new grassland and tree planting at the base of the embankment, that once established will reduce the perceived form of the earthworks and structure in views from Great Western Park to the south, and aid in its integration with the existing landscape features on the south side of the A4130;
- Lighting will be avoided across the high point of the Didcot Science Bridge to reduce the visual impact of lighting columns and to avoid train driver glare. Lighting up to, but not over, Network Rail land. Lighting is being proposed over the A4130 and Milton Road;
- To the south of the Great Western Railway Mainline, vegetation alongside Meadow Brook will be retained as far as practicable, with proposed enhancements to the watercourse; and
- The existing hedgerow on the north side of the A4130 Northern Perimeter Road as it passes Southmead Industrial Estate will be largely retained to maintain landscape structure and provide screening of traffic (refer to Arboricultural Impact Assessment and Tree Protection Plans Sheets 2 to 7 for more detail).

Didcot to Culham River Crossing

8.8.7 The following specific measures have been incorporated into the Scheme design with regard to the Didcot to Culham River Crossing:

- The landscape design seeks to integrate the Scheme by planting trees, shrubs, and hedgerows alongside the road including enhancing woodland blocks to restore vegetation patterns and strengthen the landscape structure where practicable;
- Substantial areas of proposed planting are proposed, both on the River Thames bridge in the form of a sedum blanket as well as the approaches to the Appleford Railway Sidings crossing for the purposes of landscape integration and to soften the aesthetics of these structures;
- The noise barrier located on the Appleford Railway Sidings crossing will include climbing vegetation, this will help to screen this element and assimilate it into the landscape;
- Small-scale deciduous woodland blocks using locally characteristic species are proposed around the Sutton Courtenay Roundabout to integrate the new infrastructure;
- There is a proposed link between the Scheme cycleway/footway and the Thames Path National Trail, enhancing landscape accessibility and recreation opportunities;
- Small-scale deciduous woodland blocks using locally characteristic species are proposed to the north bank of the River Thames to reduce the perceived scale of the embankment approach to the viaduct from the A415;
- There is small-scale arable reversion to grassland proposed alongside the River Thames and at the flood compensation areas, along with riparian planting to the banks of the River Thames to enhance biodiversity;

- The bridge abutment on the north side of the River Thames has been set back from the river bank and the Thames Path National Trail to retain the openness of views along the river bank for footpath users; and
- Hedges, species rich grassland and grass interplanted with bulbs alongside strategic tree planting using locally characteristic species are proposed around the Abingdon Roundabout to integrate the new infrastructure.

Clifton Hampden Bypass

8.8.8 The following specific measures have been incorporated into the Scheme design with regard to the Clifton Hampden Bypass:

- The landscape design at the Culham Science Park roundabout creates a gateway feature which gradually blends into a landscape strategy which seeks to integrate the Scheme into the wider landscape.
- Trees and hedgerows are proposed alongside the road to restore vegetation patterns and strengthen the landscape structure where possible, particularly to the north of Clifton Hampden where extensive planting is proposed to reduce a perception of fragmentation of the vegetation patterns;
- The landscape design reduces potential visual intrusion of the Scheme, with substantial planting of woodland edge scrub and low-level planting at the Culham Science Park roundabout. This becomes more heavily wooded to the east as trees and shrubs are proposed to screen both infrastructure and traffic, particularly around junctions;
- Noise barriers along this part of the Scheme will include climbing vegetation on the façade that faces road users, this will help to screen these elements and assimilate them into the landscape;
- The landscape design includes improvements to grassland adjacent to ditches and field margins in the landscape north of Clifton Hampden for biodiversity and landscape integration benefits;
- The drainage system utilises green infrastructure in the form of swales and retention basins to convey and store water, which have secondary benefits for nature and biodiversity;
- The landscape design to north of Clifton Hampden includes new recreation routes alongside retaining existing public rights of way, to enhance accessibility and recreation;
- A wide tree belt is proposed on the north side of the Clifton Hampden Bypass, north of Clifton Hampden to visually screen traffic from the PRow between the Clifton Hampden Bypass and Nuneham Courtenay to the north; and
- The B4015 connection into the north of Clifton Hampden has been moved west to retain a distinctive mature oak tree in the verge of the existing B4015. For details of tree protection and removal refer to the *Arboricultural Impact Assessment* (Ref 8.1) included with this ES.

Essential Mitigation

Construction

8.8.9 Construction of the Scheme will be subject to measures and procedures as defined within the Outline Environmental Management Plan (OEMP) (Ref 8.20) that have been developed for the Scheme. The OEMP includes a range of measures to enable compliance with relevant standards and legislation and best practice guidance that aim to minimise potential landscape and visual impacts, which include:

- Keeping construction sites and compounds tidy and in good order, for example by keeping stockpiled material to a minimum and arranging goods deliveries 'just in time';
- Use of hoarding at construction compounds to screen activity, and rendering construction buildings, hoarding, fencing and facilities in tonal colours to reflect the landscape;
- Keeping night-time works to a minimum; and
- Ensure low level and directional lighting is used to illuminate construction compounds and working areas, where possible.

8.8.10 The measures detailed within the OEMP will be developed into a Construction Environmental Management Plan (CEMP) which will be implemented by the selected construction contractor.

8.9 Assessment of Likely Impacts and Effects

8.9.1 The Scheme has the potential to result in significant landscape and visual effects during construction and operation (year 1 and year 15) as it involves the construction and operation of new road networks across the prevailing landscape.

8.9.2 As set out in the methodology (refer to Section 8.5), the assessment of impacts and effects of the Scheme has been undertaken based on the Scheme as described in *ES Chapter 2 The Scheme* and the landscape masterplans, Figure 8.72a to 8.72s, for the following scenarios:

- Construction Phase (winter) – when deciduous vegetation is not in leaf so as to represent a worst-case scenario through greater potential Scheme visibility than compared to summer conditions and assumed peak Scheme construction activity;
- Year 1 (winter) – to account for deciduous vegetation not being in leaf nor any landscape planting having established, and with the Scheme being operational; and
- Year 15 (summer) – to account for vegetation being in leaf and any new landscape planting having established, and with the Scheme being operational.

Assessment of Impacts and Effects

8.9.3 The following sections summarise the significant landscape and visual effects of the Scheme i.e. those predicted to be 'very large, large and moderate' (adverse or beneficial). All effects, both significant and not significant, are set out in Appendix 8.5 Landscape Impact Assessment and Appendix 8.6 Visual Impact Assessment, which should be read in combination with the sections below.

Effects during Construction

Effects to the Site

8.9.4 At the Site level, the Scheme construction activity will result in physical changes to landform, via excavation and the formation of new earthworks. There will also be vegetation clearance, including across the north and south banks of the River Thames.

8.9.5 The construction phase will introduce additional vehicles and machinery across the landscape, to a far greater scale than general farming activity within a rural landscape. There will be tall machinery, including cranes, as well as construction

compounds, with associated buildings, storage and processing areas and stockpiles of material.

- 8.9.6 Haul roads will be formed to provide construction access for the viaduct and bridge, with cranes used to lift the viaduct and bridge structure into place, along with other locations across the Scheme.
- 8.9.7 During Scheme construction, tranquillity will be reduced across the Site due to the perception and audible operation of construction machinery and cranes.
- 8.9.8 At the Site level, the construction phase will result in a major adverse impact. In relation to the medium sensitivity of the Site, the effect will be **Large adverse** (significant).

Effects to Published Landscape Character Areas

- 8.9.9 With reference to Appendix 8.5 Landscape Impact Assessment, the geographic extent of the Scheme construction activity will be localised in relation to the wider scale of the published LCAs. Therefore, whilst there will be changes to landform, vegetation and tranquillity at the Site level, the effects to the published landscape character assessment areas are predicted to be not significant. This includes effects upon the North Wessex Downs AONB. Refer to Appendix 8.5 for details of impact magnitudes and sensitivity.

Effects to Local Landscape Character Areas (LLCA)

- 8.9.10 The landscape impacts to the LLCAs will reflect those at the Site level, with changes to landform, vegetation patterns and the presence of construction activity for those LLCA which the Scheme is geographically located within.
- 8.9.11 For LLCA 12 Thames Floodplain, there will be a physical change to the landscape fabric as a result of vegetation clearance on the north and south banks of the River Thames, and site clearance on the north side of the river for the bridge abutment and flood mitigation area. Haul roads will be in operation to provide construction access for the viaduct and bridge, with cranes used to lift the viaduct and bridge structure into place. Construction activity will include excavation of the flood compensation area along the north bank of the river, and the creation of a new embankment approach to the viaduct abutment. Tranquillity will be reduced in the LLCA from the presence of construction machinery and construction activity. The magnitude of impact will be moderate adverse, which in relation to the medium sensitivity of the receptor will result in a **Moderate adverse** (significant) effect.
- 8.9.12 For LLCA 16 Clifton Hampden Farmland, there will be a physical change to the landscape fabric as a result of site clearance, vegetation clearance, and construction activity. This will result in a loss to the well-defined field pattern to the north of Clifton Hampden, with vegetation removal from two locations within the mature tree belts to enable construction of the new road. There will be a construction compound located in the west of the LLCA, close to the boundary with the CSC, which along with the construction machinery will be of a greater scale and perception than general farming activities. The tranquillity will be notably reduced in the landscape north of Clifton Hampden due to the construction activity. The magnitude of impact will be major adverse, which in relation to the medium sensitivity of the receptor will result in a **Large adverse** (significant) effect.
- 8.9.13 With reference to Appendix 8.5, there will be adverse effects to many of the other LLCA, but due to the smaller scale of the physical impact and reduced perception of

the construction activity, the effects are predicted as not significant. Refer to Appendix 8.5 for details of impact magnitudes and sensitivity.

Effects on Visual Amenity

- 8.9.14 Views of Scheme construction activity will be a notable change in comparison to views of a generally settled agricultural landscape.

Views from south of the A4130

- 8.9.15 For recreational users to the south of the A4130, there will be partial views of cranes operating on the skyline in the background of the view for the construction of the Didcot Science Bridge. The cranes will be seen in the context of other vertical elements on the skyline at the Didcot B Power Station site.
- 8.9.16 Construction of the A4130 Widening elements will not be visible as a result of the intervening vegetation and therefore, with reference to Appendix 8.6, significant adverse visual effects are not predicted for recreational users to the south of the A4130

Views from Didcot

- 8.9.17 In views from the settlement edge of Didcot at the Great Western Park development, from RV 7 (Figure 8.22) there will be partial views of site clearance and vegetation clearance in the middle ground of the view, along with views of construction machinery building the embankments on the approach to the Didcot Science Bridge. Cranes will be visible around the Didcot Science Bridge and seen on the skyline amongst existing tall vertical features such as the chimney stacks at Didcot B Power Station. The site compound on the south side of the Didcot Science Bridge will be partially visible at the foot of the bridge embankment.
- 8.9.18 Construction of the Northern Roundabout, Didcot Science Bridge Roundabout and link road will be less apparent in the background of the view.
- 8.9.19 The magnitude of impact for residents in the west of Didcot will be moderate, which in relation to the medium sensitivity of the receptor will result in a **Moderate adverse** (significant) effect.

Views from around the former Didcot A Power Station and Didcot B Power Station

- 8.9.20 In views from the PRow/NCN5 around the perimeter of the former Didcot A Power Station, from RV 8 (Figure 8.23) a site compound will be visible in the south of the field in the foreground of the view. The existing vegetation alongside the A4130 will be retained as much as possible, such that works to improve the carriageway will be largely screened. The cycleway/ footway will be built 'off-line' along the far field edge, with construction machinery visible for the earthworks and surfacing.
- 8.9.21 There will be partial views beyond intervening vegetation of construction of the river crossing as it heads north from Didcot, although this will be barely noticeable in the context of the view.
- 8.9.22 The magnitude of impact from this PRow will be moderate, which in relation to the medium sensitivity of the receptor will result in a **Moderate adverse** (significant) effect.

Views from south Appleford

- 8.9.23 For recreational users of the PRoW heading west, RV 10 (Figure 8.25) is located within the construction site and as such site clearance will be seen across the foreground of the view, and around the waterbody to the west. The existing access track to the mineral working and landfill sites will be stopped up and the surface broken out. Construction machinery will be operating in the foreground of the view to build the earthwork embankments on the approach to the Appleford Railway Sidings Bridge, and to surface the road. Construction activity will fundamentally (albeit temporarily) change the view.
- 8.9.24 The magnitude of impact will be major, which in relation to the low sensitivity of the receptor, will result in a **Moderate adverse** (significant) effect.
- 8.9.25 For residents at Appleford Crossing Cottage (Railway Cottages) (receptor 10a), there will be filtered views of Scheme construction activities through vegetation to the rear of the property, which will be partially retained. The construction activity will include machinery operating to construct earthworks and surface the road.
- 8.9.26 The magnitude of impact will be moderate, which in relation to the medium sensitivity of the receptor will result in a **Moderate adverse** (significant) effect.
- 8.9.27 For residents west of Main Road and north of the level crossing (receptor 10b), Scheme construction will be partially seen beyond the intervening railway line, with machinery and cranes building the Appleford Railway Sidings Bridge. Views will be oblique from most of the receptor group and principally along the existing clearing for the Appleford Railway Sidings, where there is no vegetation to screen views. However, for much of the receptor group, existing mature vegetation on the west side of the Cherwell Valley Railway Line will screen ground level views of construction, such that only the cranes will be visible.
- 8.9.28 Construction will form a noticeable feature of the view, but in the context of the existing view across the railway line, and the intervening vegetation, will not dominate the view.
- 8.9.29 The magnitude of impact will be moderate, which in relation to the medium sensitivity of the receptor will result in a **Moderate adverse** (significant) effect.

Views from B4016

- 8.9.30 For road users heading west along the B4016, from RV 16 (Figure 8.31), there will be widespread views of Scheme construction activities in the view, with site clearance and construction activity for the roundabout and Thames floodplain crossing visible across the middle ground of the view. A site compound will be located to the south of this location and will be seen in views. Construction machinery and cranes will be widely visible and noticeable in the view. At times, views of the Wittenham Clumps are likely to be interrupted by the operation of tall machinery.
- 8.9.31 The magnitude of impact will be moderate, which in relation to the medium sensitivity of the receptor will result in a **Moderate adverse** (significant) effect.

Views from Thames Path National Trail

- 8.9.32 From RV 18 (Figure 8.33) views will be channelled by vegetation towards the construction of the embankment at the bridge abutment, wing walls, and the structure. The construction activity will principally be situated below the skyline in views, but on occasion when cranes are in use they will break the skyline, albeit seen in the context of the high voltage pylons. There will be excavation works in the foreground of the view for the flood compensation area. The magnitude of impact is predicted to be

major, which in relation to the high sensitivity of the receptor will result in a **Large adverse** (significant) effect.

- 8.9.33 From RV 19 (Figure 8.34), the construction activity will be prominent across the view with the import of earthworks and materials for the embankment and bridge. Cranes will be operating close to the receptor during the construction of the bridge and viaduct. Construction activity will be the dominant feature of the view. The magnitude of impact is predicted to be major, which in relation to the high sensitivity of the receptor will result in a **Very Large adverse** (significant) effect.
- 8.9.34 From RV 20 (Figure 8.35), construction activity will be prominent across the view with the import of earthworks and materials for the embankment, bridge, and wing walls. Cranes will be operating close to the receptor during the construction of the bridge and viaduct. Construction activity will be the dominant feature of the view. The magnitude of impact is predicted to be major, which in relation to the high sensitivity of the receptor will result in a **Very Large adverse** (significant) effect.
- 8.9.35 From RV 21 (Figure 8.36), views are channelled by vegetation towards the construction of the embankment at the bridge abutment, wing walls, and the structure. The construction activity will principally be below the skyline, but there will be a notable change to the view. The magnitude of impact is predicted to be major, which in relation to the high sensitivity of the receptor will result in a **Large adverse** (significant) effect.

Views from west of Culham Science Centre

- 8.9.36 From RV 23 (Figure 8.38) and RV 24 (Figure 8.39), the clearance of hedgerows where the Scheme joins the A415, and site clearance north and south of the road will be visible. The north of the A415 to the left of the view will include a site compound. There will be construction machinery for re-grading the road and setting out the road surface.
- 8.9.37 The magnitude of impact for RV 23 to RV 24 will be major, which in relation to the low sensitivity of the receptors, will result in **Moderate adverse** (significant) effects.

Views from the entrance to Culham Science Centre

- 8.9.38 For road users and people travelling to work at the entrance to CSC close to Culham Station, from RV 26 (Figure 8.41) construction activity will be visible across all of the composition of the view, via site clearance, construction machinery undertaking earthworks for the CSC roundabout, cycleways, and drainage basins. Construction will fundamentally alter the view.
- 8.9.39 The magnitude of impact will be major, which in relation to the low sensitivity of the receptor will result in a **Moderate adverse** (significant) effect.
- 8.9.40 For residents south of the A415 at Fullamoor, from RV 27 (Figure 8.42) during construction there will be widespread clearance of vegetation across the foreground and mid-ground of the view. There will be construction machinery operating to build up the embankments and surface the new road, as well as excavation of the drainage basins. Due to the close location of the receptor, construction activities will dominate the view.
- 8.9.41 The magnitude of impact will be major, which in relation to the medium sensitivity of the receptor will result in a **Large adverse** (significant) effect.

- 8.9.42 In views from along the A415, from RV 28 (Figure 8.43) site clearance across the CSC entrance including vegetation removal, earthworks, and road construction will be visible.
- 8.9.43 The magnitude of impact will be major, which in relation to the low sensitivity of the receptor will result in a **Moderate adverse** (significant) effect.

Views from around Clifton Hampden

- 8.9.44 For recreational users of PRoW 171/10 looking east from the boundary of CSC, from RV 31 (Figure 8.46) during Scheme construction, there will be close views of site clearance and vegetation clearance within part of the treeline to the east, which will break the linearity of the tree line as a feature within the view. Construction activity will be a dominant feature of the view.
- 8.9.45 The magnitude of impact will be major, which in relation to the medium sensitivity of the receptor will result in a **Large adverse** (significant) effect.
- 8.9.46 For recreational users of PRoW 171/10 looking north from west of Clifton Hampden, from RV 32 (Figure 8.47) during Scheme construction, there will be views of construction across the field in the mid-ground, with the Scheme constructed at grade, with construction machinery excavating drainage swales, and surfacing the new road.
- 8.9.47 The magnitude of impact will be major, which in relation to the medium sensitivity of the receptor will result in a **Large adverse** (significant) effect.
- 8.9.48 For recreational users of PRoW 171/6 looking towards Clifton Hampden, from RV 34 (Figure 8.49), PRoW 171/3 in the north of Clifton Hampden, from RV 36 (Figure 8.51) and residents north of Clifton Hampton (RV 36a) during construction, there will be close views of site clearance and vegetation clearance within part of the treeline to the right of the view, such that the construction activity will be noticeable in the view.
- 8.9.49 The magnitude of impact will be major, which in relation to the medium sensitivity of these receptors will result in a **Large adverse** (significant) effect.
- 8.9.50 For recreational users of PRoW 171/5 looking north from Clifton Hampden, from RV 37 (Figure 8.52) and recreational users of PRoW 171/3 looking south towards Clifton Hampden, from RV 38 (Figure 8.53) there will be close range views of site clearance and the formation of the embankments. Construction machinery and activity for excavating drainage swales and surfacing the new road will also be visible and a dominant feature of the view.
- 8.9.51 The magnitude of impact will be major, which in relation to the medium sensitivity of these receptor will result in a **Large adverse** (significant) effect.

Effects at Completion and Operation (Year 1 - winter)

Year 1 Effects at the Site Level

- 8.9.52 At year 1, the Scheme will result in a change in land use across the Site, via the road and associated structures, including lighting columns and vehicles. There will be substantial areas of new planting; however, this will be low in height, such that it will not have fully established.
- 8.9.53 With reference to ES Chapter 10: Noise and Vibration, there will be an increase in traffic noise along the length of the Scheme once it is operational. However, ES

Chapter 10 predicts a significant reduction in noise as a result of traffic diverting onto the Scheme from the local road network, for residents of Appleford, Long Wittenham, Sutton Courtenay, Culham, and Clifton Hampden. The audible impact of the Scheme on tranquillity can therefore be broadly described as improving for a high number of residents in nearby villages and the wider landscape, whilst decreasing for a small number of residents in proximity to the Scheme, as reported in ES Chapter 10.

- 8.9.54 The landscape character at the Site level will be altered, including the tranquillity, such that the magnitude of impact will be major adverse. In relation to the medium sensitivity of the Site landscape character, the effect is predicted to be **Large adverse** (significant).

Year 1 Effects to Published Landscape Character Areas

- 8.9.55 In relation to the published landscape character areas, the Scheme will introduce additional highways infrastructure within the landscape, including another crossing of the River Thames.
- 8.9.56 With reference to Appendix 8.5 Landscape Effects, the relatively small geographic scale of the Scheme in relation to the wider extent of the published landscape character areas is the main reason the Scheme will not result in significant adverse effects. This includes effects upon the North Wessex Downs AONB. Refer to Appendix 8.5 for details of impact magnitudes and sensitivity.

Year 1 Effects to Local Landscape Character Areas (LLCA)

- 8.9.57 For LLCA 12 Thames Floodplain, the Scheme will reduce tranquillity at a localised level. The viaduct, embankment and flood compensation area will alter the landscape pattern, although in an area which already includes engineered earthworks and rail infrastructure on embankment.
- 8.9.58 The proposed cycle and pedestrian infrastructure associated with the Scheme will provide a new direct link to the Thames Path National Trail, increasing the recreational value of the LLCA, via increased accessibility. The alignment of the road on the viaduct and bridge will locally limit the impact of severance by retaining the open character and connectivity of the landscape beneath the viaduct.
- 8.9.59 The Scheme includes substantial planting on and around the embankment to reduce its perceived scale and integrate it with the existing landscape pattern, but the planting will not yet be fully established. Similarly, proposed riparian planting along the banks of the River Thames to replace vegetation cleared during construction and enhance the riparian habitats along the bank of the River Thames, will not have fully established.
- 8.9.60 The magnitude of impact will be moderate adverse, resulting in a **Moderate adverse** (significant) effect.
- 8.9.61 For LLCA 16 Clifton Hampden Farmland, the Scheme will form a partial change in land use with the loss of arable field and introduction of the Clifton Hampden Bypass, a new connection to the B4015 on the north entrance to Clifton Hampden, greened noise barriers, drainage retention basins and swales, signage, and lighting columns.
- 8.9.62 The Scheme incorporates a pedestrian and cycle links towards CSC and accommodates existing PRow such that there will be a limited change to the recreational value as a result of the Scheme.

- 8.9.63 The Scheme is through an area with a sense of enclosure, which will be partially reduced by the introduction of the Clifton Hampden Bypass. The tranquillity of the LLCA will be substantially reduced by the introduction of the Scheme, associated infrastructure, and traffic using the new road.
- 8.9.64 There is extensive new planting proposed around the Clifton Hampden Bypass to reduce the perceived fragmentation of the field and vegetations pattern by integrating the Scheme with the existing retained vegetation. The proposed planting seeks to respond to the baseline landscape character of the LLCA by:
- Strengthening existing tree belts and introducing new tree belts alongside the highway;
 - Planting woodland blocks to reduce the fragmentation of the field pattern and strengthen the landscape structure; and
 - Reverting areas of arable field to species-rich grassland to improve the biodiversity value.
- 8.9.65 The new connection to the B4015 north of Clifton Hampden has been located 'off-line' from the existing road in order to retain the existing trees on the eastern side of the road and a distinctive mature oak tree on the west side of the road; in addition, a new avenue of trees are proposed (Figure 8.72s) on the realigned B4015 connection to enhance the new gateway to Clifton Hampden, and create a sense of separation from the bypass.
- 8.9.66 At year 1 however, the landscaping will not yet be fully established to reduce the perception of the Scheme and there will be change to the landscape pattern and structure from the Scheme.
- 8.9.67 The magnitude of impact will be major adverse, resulting in a **Moderate adverse** (significant) effect.
- 8.9.68 With reference to Appendix 8.5, the Scheme at year 1 will result in adverse impacts to many of the other LLCAs; however, due to the smaller geographic scale of the Scheme within the LLCA, or the reduction in perception due to increased distance from the Scheme, the effects are predicted to be not significant. Refer to Appendix 8.5 for details of impact magnitudes and sensitivity.

Year 1 Effects on Visual Amenity

Views from south of the A4130

- 8.9.69 For recreational users to the south of the A4130, the intervening vegetation will screen views of the Scheme, such that significant adverse effects are not predicted at year 1 for recreational users.

Views from Didcot

- 8.9.70 In views from the settlement edge of Didcot at the Great Western Park development, from RV 7, with reference to photomontage VP07 (Figures 8.75a to 8.75d), the Didcot Science Bridge will be visible crossing the existing A4130 in the middle ground of the view, with Milton Park and the Didcot B Power Station forming the background of the view behind the new structure. The bridge will not break the skyline of the view, with the structure, and the traffic on it, sitting below the skyline formed by the tall warehouses and industrial buildings including the Hachette Building and at Milton Park. The embankment and bridge structure will not be out of scale with the existing built form in the background of the view. Highway infrastructure such as lighting and signage will be seen alongside the new road on the embankments.

- 8.9.71 The magnitude of impact for residents in the west of Didcot will be moderate, which in relation to the medium sensitivity of the receptor will result in a **moderate adverse** (significant) effect.

Views from south Appleford

- 8.9.72 For recreational users of PRow heading west, from RV 10 with reference to photomontage VP10 (Figures 8.76a and 8.76d), the Scheme will be sited across the foreground of the view, with traffic using the Scheme also in the foreground of the view. Highway infrastructure such as lighting columns and signage will be in the foreground of the view at the pedestrian crossing, which will have a somewhat urbanising impact on the existing composition of the view.
- 8.9.73 The magnitude of impact will be major, which in relation to the low sensitivity of the receptor will result in a **Moderate adverse** (significant) effect.

8.9.74 For residents at Appleford Crossing Cottage (Railway Cottages) (receptor 10a), at operational year 1, the receptor will experience filtered views of the Scheme through intervening vegetation, with views principally onto the greened noise barrier. The Scheme will be approximately on the alignment of the existing access track but will have a more urbanising appearance than the existing access track, including lighting columns.

- 8.9.75 The magnitude of impact will be moderate, which in relation to the medium sensitivity of the receptor will result in a **Moderate adverse** (significant) effect.

8.9.76 For residents west of Main Road and north of the level crossing (receptor 10b), there will be oblique views of the Appleford Sidings Bridge, principally along the existing clearing for the Appleford Railway Sidings, where there is no vegetation to screen views. The embankments on the southern approach to the bridge will be partially visible along with the greened noise barriers.

- 8.9.77 The magnitude of impact will be moderate, which in relation to the medium sensitivity of the receptor will result in a **Moderate adverse** (significant) effect.

Views from Thames Path National Trail

- 8.9.78 From RV 18, with reference to photomontage VP 18 (Figures 8.81a and 8.81d), the bridge abutment and embankment will be partially visible, with vegetation channelling the view towards the structure. The proposed structure will sit below the Wittenham Clumps, such that views towards the Wittenham Clumps will not be totally interrupted by the Scheme.
- 8.9.79 The flood compensation area in the foreground will be seeded with grassland and graded back into the contours such that it will not be wholly out of place within the composition of the view.
- 8.9.80 From RV 19, with reference to photomontage VP 19 (Figures 8.82a and 8.82d), at operational year 1 the embankment and bridge will form the new skyline from this close perspective and will be the dominant feature in the view. Traffic will be noticeable from this close position using the structure.
- 8.9.81 The bridge has an open span extending away from the river to try and retain views along the Thames Path and river bank.
- 8.9.82 From RV 20, with reference to photomontage VP20 (Figures 8.83a and 8.83b), the embankment and bridge will form the new skyline from this close range and will be

the dominant feature in the view. Traffic using the structure will also be visible at close range.

- 8.9.83 From RV 21, with reference to photomontage VP21 (Figures 8.84a and 8.84d), the bridge abutment and embankment will be partially visible, with vegetation channelling the view towards the structure. The proposed structure will sit below the skyline but result in a notable change to the view.
- 8.9.84 For RV 19 and 20 the magnitude of impact will be major, which in relation to the high sensitivity of the receptors will result in a **Very Large adverse** (significant) effect.
- 8.9.85 For RV 18 and 21 the magnitude of impact will be moderate, which in relation to the high sensitivity of the receptors will result in a **Moderate adverse** (significant) effect.

Views from the entrance to Culham Science Centre

- 8.9.86 For residents south of the A415 at Fullamoor, from RV 27, with reference to photomontage VP27 (Figures 8.87a and 8.87d), the cycleway and private means of access will be visible in the foreground of the view. The Scheme will be visible on embankment beyond the retained A415, although screening views of the CSC beyond.
- 8.9.87 The fencing, signage and lighting columns will be visible, along with views of the drainage ponds and of traffic using the road.
- 8.9.88 The magnitude of impact will be major, which in relation to the medium sensitivity of the receptor will result in a **Moderate adverse** (significant) effect.

Views from around Clifton Hampden

- 8.9.89 For the following receptors, there will be close views of the Scheme as it passes through the field in the foreground, introducing a road, traffic, and highway infrastructure to the view:
- Recreational users of PRoW 171/10 looking east from the boundary of Culham Science Centre, from RV 31, with reference to photomontage VP31 (Figures 8.88a and 8.88b);
 - For recreational users of PRoW 171/10 looking north from west of Clifton Hampden, from RV 32, with reference to photomontage VP32 (Figures 8.89a and 8.89d);
 - PRoW 171/6 looking towards Clifton Hampden, from RV 34, with reference to photomontage VP34 (Figures 8.90a and 8.90d);
 - For recreational users of PRoW 171/3, from RV 36, with reference to photomontage VP36 (Figures 8.91a and 8.91d);
 - Residents in the north of Clifton Hampden (receptor 36a);
 - PRoW 171/5 looking north from Clifton Hampden, from RV 37, with reference to photomontage VP37 (Figures 8.92a and 8.92d); and
 - PRoW 171/3 looking south towards Clifton Hampden, from RV 38, with reference to photomontage VP 38 (Figures 8.93a and 8.93d).
- 8.9.90 For these receptors, the magnitude of impact will be major, which in relation to medium sensitivity of the receptors will result in a **Large adverse** (significant) effect.

Effects at Completion and Operation Summer (Year 15)

Year 15 Effects at the Site Level

- 8.9.91 Compared to the year 1 assessment, the Scheme planting will have established to be taller in height. This will aid in reducing the perception of the Scheme, associated highway infrastructure and vehicles, although the change in land use will be permanent, along with the severance to the landscape from the new road.
- 8.9.92 The magnitude of impact will therefore remain major. In relation to the medium sensitivity of the Site, the effect at year 15 will reduce to **Moderate adverse** (significant) due to the establishment of the proposed planting.

Year 15 Effects on Landscape Character Areas

- 8.9.93 In relation to the published landscape character areas, the establishment of the proposed planting will reduce the perception of the Scheme; although as per the impacts at the Site scale, the change in land use and new road infrastructure will be a permanent change.
- 8.9.94 With reference to Appendix 8.5, the relatively localised scale and extent of the Scheme will not result in significant adverse effects to published landscape character areas. This includes effects upon the North Wessex Downs AONB. Refer to Appendix 8.5 for details of impact magnitudes and sensitivity.

Year 15 Effects to Local Landscape Character Areas

- 8.9.95 At operational year 15, the proposed landscaping will have established, and as a result the significant landscape effects reported for LLCA 12 and LLCA 16 at operational year 1 will be reduced. There will be no significant adverse landscape effects at year 15 to local landscape character areas. Refer to Appendix 8.5 for details of impact magnitudes and sensitivity, and resultant effects.

Effects on Visual Amenity Year 15

- 8.9.96 Compared to the year 1 assessment, the visible extent of the Scheme will reduce due to the retained vegetation and new planting being in leaf. The new planting will have established, and be taller in height than at year 1.
- 8.9.97 With reference to Appendix 8.6, the predicted moderate and major magnitudes of impact predicted for the year 1 assessment will reduce. There will be adverse changes to people's views, including from the A4130 and around the former Didcot A Power Station, but the effects are predicted not to be significant. Refer to Appendix 8.6 for details of impact magnitudes and sensitivity, and resultant effects.

Views from south Appleford

- 8.9.98 For recreational users of PRow heading west, from RV 10, with reference to Figures 8.76c and 8.76d, visibility of the Scheme will not change between summer and winter, or year 1 and 15.
- 8.9.99 The visual effect will therefore not change from year 1. The magnitude of impact will be major, resulting in a **Moderate adverse** (significant) effect.

Views from Thames Path National Trail

8.9.100 The proposed planting around the bridge embankment will have established to soften views of part of the structure, whilst the remainder of the bridge will remain visible for the following receptors:

- RV 18, with reference to photomontage VP18 Figures 8.81c and 8.81d;
- RV 19, with reference to photomontage VP19 Figures 8.82c and 8.82d;
- RV 20, with reference to photomontage VP 20 Figures 8.83c and 8.83d; and
- RV 21, with reference to photomontage VP21 Figures 8.84c and 8.84d.

8.9.101 For these receptors the magnitude of impact will vary between major and moderate. In relation to the high and medium sensitivity of these receptors, the effects will range between **Large adverse** (significant) and **Moderate adverse** (significant).

Views from the entrance to Culham Science Centre

8.9.102 For residents south of the A415 at Fullamoor, from RV 27, with reference to photomontage VP27 (Figures 8.87c and 8.87d), at operational year 15 the proposed tree and shrub planting will be established and maturing, providing a degree of landscape structure and integration, and reducing the impact of traffic. The magnitude of impact will remain major, retaining a **Moderate adverse** (significant) effect.

Views from around Clifton Hampden

8.9.103 For recreational users of PRow 171/10 looking east from the boundary of CSC, from RV 31, with reference to photomontage VP31 (Figures 8.88c and 8.88d), by operational year 15 the proposed planting will be established and maturing, visually screening the highway and traffic from the view, and integrating the Scheme such that the view better reflects the baseline characteristics. The planting itself will change the view but will be in keeping with the visual characteristics of the area.

8.9.104 The magnitude of impact will reduce to moderate, resulting in a **moderate adverse** (significant) effect.

8.9.105 For recreational users of PRow 171/6 looking towards Clifton Hampden, from RV 34, with reference to photomontage VP34 (Figures 8.90c and 8.90d), by operational year 15 the proposed planting will be established and maturing, visually screening the highway and traffic from the view, and integrating the Scheme such that the view better reflects the baseline characteristics. Views towards the edge of Clifton Hampden will be interrupted by the planting, which itself will change the view, but will be in keeping with the visual characteristics of the area.

8.9.106 The magnitude of impact will remain major, but the visual effect will reduce to **moderate adverse** (significant).

8.9.107 For residents in the north of Clifton Hampden (receptor 36a) and recreational users of PRow 171/3, from RV 36, with reference to photomontage VP36 Figures 8.91c and 8.91d, by operational year 15 the proposed planting will be established and maturing, visually screening the highway and traffic from the view, and integrating the Scheme such that the view better reflects the baseline characteristics. The planting itself will change the view but will be in keeping with the visual characteristics of the area.

- 8.9.108 The magnitude of impact will reduce to moderate, and the visual effect will reduce to **moderate adverse** (significant).
- 8.9.109 For recreational users of PRoW 171/5 looking north from Clifton Hampden, from RV 37, with reference to photomontage VP37 (Figures 8.92c and 8.92d), by operational year 15 the proposed planting will be established and maturing, softening the appearance of highway infrastructure, and integrating the Scheme such that the view better reflects the baseline characteristics. The planting itself will change the view but will be in keeping with the visual characteristics of the area.
- 8.9.110 The magnitude of impact will remain major, but the visual effect will reduce to **moderate adverse** (significant).

Effects on the Character of the Night Sky

- 8.9.111 As set out in ES Chapter 2, in operation, the Scheme will introduce new lighting at junctions, roundabouts, and along the full length of the footway and cycleway. There will also be lighting from vehicle headlights along the road. The localised glare from vehicles will be reduced by the establishment of the proposed planting and localised earthworks.
- 8.9.112 At the Site level, the lighting will be a new uncharacteristic feature and the impact is assessed as major adverse. In relation to the medium sensitivity of the Site, the effect is predicted to be moderate adverse (significant).
- 8.9.113 In relation to the local landscape character areas, the additional lighting will not alter the extent of sky glow in relation to Didcot and settlements in the southern part of the study area. The proximity of the Scheme to existing light sources and sky glow will therefore result in a negligible adverse impact for LLCAs 1 to 5. The existing lighting zones of between E2 and E4 are also considered to remain and the effects will range between neutral and slight adverse (not significant) for LLCAs 1 to 5.
- 8.9.114 In the central and northern part of the study area, between Didcot and Hampden, the Scheme lighting and vehicles will introduce additional lighting in comparison to limited sky glow and sources of lighting across LLCAs 9, 12, 14 and 16. The extent of sky glow and glare will be localised in these areas, and in relation to the lighting at the roundabouts, occur at existing road networks and sources of lighting. The impacts are predicted to be minor adverse and the effects are predicted to be slight adverse (not significant).
- 8.9.115 For the remaining LLCAs, which are not crossed by the Scheme, the impacts are assessed as ranging between negligible adverse and no change and the effects are predicted to be not significant.
- 8.9.116 In relation to the published landscape character areas, which cover a wider geographic area, the Scheme lighting will not alter the overall extent of glare and sky glow. The impacts are assessed as negligible adverse and the effects are predicted to range between neutral and slight adverse (not significant).
- 8.9.117 There will be no change to the character of the night sky in relation to the North Wessex Downs AONB. This is due to the distance from the Scheme.

Cumulative Effects

- 8.9.118 ES Chapter 17: Assessment of Cumulative Effects, presents details of the future planned developments that may influence the baseline conditions prior to the

construction of the Scheme. The cumulative effects of these developments have been taken into account of as part of the cumulative assessment.

8.9.119 The cumulative landscape and visual effects are set out in Appendix 8.7 Cumulative Landscape and Visual Impacts.

8.9.120 The cumulative developments which are included in the landscape and visual cumulative assessment are:

- Ladygrove East (ID 1), 642 residential dwellings;
- Didcot North East (ID 2), a mixed-use development comprising up to 400 dwellings;
- Didcot A Power Station site (ID 3), 400 dwellings; and
- Land to west of Great Western Park (ID 6), a large-scale mixed-use development with 4,254 residential dwellings.

8.9.121 All of these are considered to have temporal overlap in the construction and operational phases of the Scheme and are within the LVIA study area.

8.9.122 The following cumulative developments have been scoped out of the assessment due to the distance from the Scheme:

- Land north of Dunmore Road and Twelve Acre Drive Abingdon (ID 8); and
- Land north west of Abingdon-on-Thames Land bound by Wootton Road, Dunmore Road and the A34 Abingdon-on-Thames (ID 9).

Cumulative Landscape Effects

8.9.123 In relation to the published landscape character assessments, the landscape effects will remain as predicted for the assessment of the Scheme, given that there will be no significant adverse cumulative landscape effects on the published LCAs.

8.9.124 The geographic extent of the Scheme and cumulative development construction and operational activities will be localised in relation to the wider scale of the NCA 108: Upper Thames Clay Vales.

8.9.125 Within the assessment of the cumulative landscape impacts of the Scheme on the LCAs identified within the Oxfordshire Wildlife and Landscape Study (OWLS), only two LCAs have cumulative developments within them: WH/20 Sutton Courtenay and WH/1 Lower River Thames. Again, the geographic extent of the Scheme and relevant cumulative development construction, and operational, activity will be localised in relation to the wider scale of the LCAs.

8.9.126 No cumulative developments are located within the LCAs identified at baseline within the SODC Landscape Assessment, the VoWHDC Landscape Assessment, or the North Wessex Downs AONB Landscape Assessment.

8.9.127 Within the assessment of the cumulative landscape impacts of the Scheme on the LLCAs, the majority of cumulative landscape effects remain as per the landscape effects predicted for the Scheme. This is because there are no identified cumulative developments within those LLCAs.

8.9.128 The exception will be to LLCA 3 Didcot Farmland; however, the effect remains not significant.

Cumulative Visual Effects

- 8.9.129 Within the assessment of the cumulative visual impacts of the Scheme for the visual receptors at the 48 representative viewpoints identified within the visual baseline for the LVIA, the majority of cumulative effects remain as per the visual effects predicted for the Scheme in isolation. This is because for the majority of these views, the cumulative developments will not be visible.
- 8.9.130 There are 15 representative viewpoints where the change to a visual receptors' view will have the potential to be influenced by the Scheme and the cumulative developments. Those cumulative developments are:
- Ladygrove East (ID 1), 642 residential dwellings, in views from RV 47;
 - Didcot North East (ID 2), a mixed-use development comprising up to 400 dwellings, in views from RV 8, 11, 12, 12a, 13, 41, 47, 48;
 - Didcot A Power Station site (ID 3), 400 dwellings, in views from RV 42; and
 - Land to west of Great Western Park (ID 6), a large-scale mixed-use development with 4,254 residential dwellings, in views from RV 1, 3, 4, 5, 6, 6a, 7.
- 8.9.131 For these 15 representative viewpoints, the majority of the cumulative effects will remain as per the visual effects predicted for the Scheme. This, in most cases, is because the construction or operational activities of the cumulative developments will be viewed in the same context of the Scheme and do not alter the overall extent of change within the view, thereby retaining the same impact and the resulting effect. From a number of the representative viewpoints it is only views of the upper parts of cranes at the cumulative developments that are likely to be visible in combination with the Scheme's construction activity.
- 8.9.132 Compared to the assessment of the Scheme only, there will be a change in cumulative visual effects experienced by receptors at RV 6, 6a, and 7, as set out below.
- 8.9.133 RV 6 is a view from south of the A4130 and represents both recreational users and residents (6a), looking north towards the Scheme from PRow 243/1, west of Didcot. The receptor is within the footprint of the large-scale mixed-use development at Land to west of Great Western Park (ID 6). The views of Scheme construction of the proposed 'off-line' westbound carriageways in views north, and construction of the Backhill Roundabout to the west, will be viewed in the context of the cumulative development site construction activities in the foreground, including vegetation clearance. The magnitude of visual impact will increase for the receptor when compared to views of the Scheme; however, this will be as a result of construction activity related to the cumulative development and not the Scheme. The visual impact of construction related to the Scheme will be reduced due to it now being in the background of the view, beyond other more prominent construction activity.
- 8.9.134 Therefore, the cumulative visual magnitude of impact of the Scheme at construction will be minor adverse, resulting in a reduction from a **Moderate adverse** (significant) visual effect to a **Slight adverse** cumulative visual effect, which is not significant.
- 8.9.135 During operational Year 1, there will be oblique views towards the new westbound carriageway of the A4130 Widening, and direct views towards the Backhill Roundabout. However, the impact of this and the increased amount of traffic, lighting and signage will be reduced due to the intervening cumulative development (ID 6), which will effectively screen views of the Scheme. The magnitude of visual impact will increase for the receptor; however, this will be as a result of the cumulative development which will be between the receptor and the Scheme. The visual impact

of the Scheme will be reduced due to it now being screened by the cumulative development.

8.9.136 Therefore, the cumulative visual magnitude of impact of the Scheme will be reduced to **Neutral**.

8.9.137 At operational Year 15, there will be no change from the operational year 1 assessment.

8.9.138 RV 7 represents residential receptor views from the north-west of Didcot. The land in the foreground of the view is allocated for development as part of the Valley Park Scheme, large-scale mixed-use development at Land to west of Great Western Park (ID 6). During construction, the magnitude of visual impact will increase for the receptor; however, this will be as a result of the cumulative development which will be between the receptor and the Scheme. The visual impact of the Scheme construction activity will be reduced due to it now being in the background of the view of other construction activity.

8.9.139 Therefore, the cumulative visual magnitude of impact will be reduced, resulting in a reduction from a **Moderate adverse** (significant) visual effect to a **Slight adverse** cumulative visual effect, which is no longer significant.

8.9.140 During operational Year 1, The Didcot Science Bridge will be visible in the middle ground of the view, but views of the cumulative development at Land to west of Great Western Park (ID 6) between the receptor and the Scheme will partially screen and therefore reduce the impact of the Scheme.

8.9.141 The visual magnitude of impact will be reduced from moderate to minor, resulting in a reduction from a **Moderate adverse** (significant) visual effect to a **Slight adverse** cumulative visual effect, which is no longer significant.

8.9.142 At operation Year 15, there will be no change from the year 1 assessment.

8.10 Monitoring

8.10.1 There are no landscape and visual significant effects which are considered to require monitoring, either during the construction or operation phase.

8.10.2 This is based upon the successful implementation of the CEMP during the construction phase and the LBMP during the operation phase.

8.10.3 The CEMP will include measures to protect retained vegetation in accordance with the AIA (Ref 8.1). The Landscape and Biodiversity Management Plan (LBMP) will detail annual monitoring of planting areas during the establishment period, with replacements to be provided for any failures, as set out in the OLBMP (Ref 8.21).

8.10.4 On that basis, no monitoring of significant effects is proposed.

8.11 Summary

8.11.1 The Scheme will result in a range of significant adverse landscape and visual effects due to the introduction of a new road and river crossing and associated lighting, within a predominantly agricultural landscape.

8.11.2 The Scheme design has included measures to reduce the landscape and visual impacts, however the inherent changes to the prevailing landscape brought about by the Scheme will result in an inevitable change which cannot be avoided through

design changes, or completely reduced through the application of standard mitigation measures and landscape planting.

- 8.11.3 The Site covers land which is safeguarded for development within the SODC and VoWH Local Plans. The Scheme is therefore located across land which is considered to be able to accommodate change in landscape and visual terms.

Landscape Effects

- 8.11.4 Significant adverse landscape effects are predicted during Scheme construction for:
- The Site;
 - LLCA 12 Thames Floodplain; and
 - LLCA 16 Clifton Hampden Farmland.
- 8.11.5 These significant effects are due to site clearance, vegetation clearance, construction activity, and the operation of machinery including cranes which will involve the loss of baseline features or elements of the landscape. The nature of the construction activity is such that these effects cannot be fully avoided or mitigated.
- 8.11.6 Significant adverse landscape effects are predicted at operational year 1 for:
- The Site;
 - LLCA 12 Thames Floodplain; and
 - LLCA 16 Clifton Hampden Farmland.
- 8.11.7 Significant adverse landscape effects on the LLCAs above is principally due to the predominantly rural characteristics of the baseline landscape, where there is limited or no existing highway infrastructure such that regardless of design and mitigation measures, the Scheme represents a fundamental change to landscape character. The landscape impact at each LLCA will be localised, relating closely to the Scheme corridor.
- 8.11.8 There will also be significant adverse effects to the character of the night sky at the Site level due to the introduction of new highways lighting and vehicle lighting.
- 8.11.9 By operational year 15, once the proposed new landscape planting has established across the Scheme, the earthworks will be better integrated into the underlying pattern of landform, the extent of vegetation loss will be mitigated and the perception of the Scheme will reduce. Due to this, there will be no permanent significant landscape effects beyond those at the Site level, which are considered to be inevitable from the change in land use.
- 8.11.10 Table 8.12 summarises the significant adverse landscape effects predicted as a result of the Scheme.

Visual Effects

- 8.11.11 Significant adverse visual effects are predicted during Scheme construction in views from:
- Didcot, for residents on the perimeter of Great Western Park;
 - around the former Didcot A Power Station, for users of PRow 373/24;

- south Appleford, for recreational users of 106/4, residents at Appleford Crossing Cottage, and residents west of Main Road north of Appleford level crossing;
- the B4016, for road users between Sutton Courtenay and Appleford;
- the Thames Path National Trail, between approximately 0.5 km either side of the Scheme;
- west of Culham Science Centre, for road users along the A415;
- the entrance to Culham Science Centre, for road users at Station Road and the A415, and residents at Fullamoor; and
- around Clifton Hampden, for residents along the northern edge of the village, and users of PRow between Clifton Hampden, Culham Science Centre, and Nuneham Courtenay.

8.11.12 Each of these visual receptors is close to the Scheme, where construction activity and machinery such as cranes are anticipated to be prominent or notably alter the view. These significant effects will be temporary, lasting only during the Scheme construction period.

8.11.13 Significant adverse visual effects are predicted at operational year 1 in views from:

- Didcot, for residents on the perimeter of Great Western Park;
- south Appleford, for recreational users of 106/4, residents at Appleford Crossing Cottage, and residents west of Main Road north of Appleford level crossing;
- the Thames Path National Trail, between approximately 0.5 km either side of the Scheme;
- the entrance to Culham Science Centre, for residents at Fullamoor; and
- around Clifton Hampden, for residents along the northern edge of the village, and users of PRow between Clifton Hampden, Culham Science Centre, and Nuneham Courtenay.

8.11.14 The number of significant visual effects during the Scheme year 1 of operation are less than those predicted during Scheme construction. The impacted visual receptors continue to be close to the Scheme, where the new highway and infrastructure will form a notable change to views. These significant effects will reduce over time as the Scheme's mitigation planting establishes.

8.11.15 Significant adverse visual effects are predicted at operational year 15 in views from:

- south Appleford, for recreational users of 106/4;
- the Thames Path National Trail, between approximately 0.5 km either side of the Scheme;
- the entrance to Culham Science Centre, for residents at Fullamoor; and
- around Clifton Hampden, for residents along the northern edge of the village, and users of PRow between Clifton Hampden, Culham Science Centre, and Nuneham Courtenay.

8.11.16 This represents a reduction in the number of significant adverse visual effects predicted during the Scheme year 1 of operation due to the Scheme landscaping becoming established and maturing. The operational year 15 effects are considered to be permanent. For each of these receptors, either the Scheme cannot be

effectively screened or integrated into views by planting, or even when the proposed mitigation planting has established and matured, the planting will represent an adverse change to the view when compared to the baseline situation.

8.11.17 Table 8.13 summarises the significant adverse visual effects predicted as a result of the Scheme.

Cumulative Effects

8.11.18 There are no significant cumulative landscape and visual effects predicted as a result of the Scheme combined with any of the cumulative schemes.

Table 8.13: Summary of likely significant landscape effects during construction and operation

Receptor/	Receptor Sensitivity	Impact Description	Design and Mitigation Measures	Impact Magnitude	Residual Effect
Construction (winter)					
The Site	Medium	Temporary (short-term)	Refer to Section 8.9	Major adverse	Large adverse
LLCA 12 Thames Floodplain	Medium	Temporary (short-term)	Refer to Section 8.9	Moderate adverse	Moderate adverse
LLCA 16 Clifton Hampden Farmland	Medium	Temporary (short-term)	Refer to Section 8.9	Major adverse	Large adverse
Operation (Year 1 Winter)					
The Site	Medium	Temporary (short-term)	Refer to Section 8.9	Major adverse	Large adverse
LLCA 12 Thames Floodplain	Medium	Temporary (long-term)	Refer to Section 8.9	Moderate adverse	Moderate adverse
LLCA 16 Clifton Hampden Farmland	Medium	Temporary (long-term)	Refer to Section 8.9	Major adverse	Moderate adverse
Operation Year (Year 15 Summer)					
The Site	Medium	Permanent (long-term)	Refer to Section 8.9	Major adverse	Moderate adverse

Table 8.14: Summary of likely significant visual effects during construction and operation

Receptor/	Receptor Sensitivity	Impact Description	Design and Mitigation Measures	Impact Magnitude	Residual Effect
Construction					
Views from Didcot					
7 – Residents	Medium	Temporary (short-term)	Refer to Section 8.9	Moderate	Moderate adverse
Views from around the former Didcot A Power Station and Didcot B Power Station					
8 – Recreational users	Medium	Temporary (short-term)	Refer to Section 8.9	Moderate	Moderate adverse
Views from south Appleford					
10 – Recreational users	Low	Temporary (short-term)	Refer to Section 8.9	Major	Moderate adverse
10a – Residents	Medium	Temporary (short-term)	Refer to Section 8.9	Moderate	Moderate adverse
10b – Residents	Medium	Temporary (short-term)	Refer to Section 8.9	Moderate	Moderate adverse
Views from B4016					
16 – Road users	Medium	Temporary (short-term)	Refer to Section 8.9	Moderate	Moderate adverse
Views from Thames Path National Trail					
18 – Recreational users	High	Temporary (short-term)	Refer to Section 8.9	Major	Large adverse
19 – Recreational users	High	Temporary (short-term)	Refer to Section 8.9	Major	Very Large adverse

Receptor/	Receptor Sensitivity	Impact Description	Design and Mitigation Measures	Impact Magnitude	Residual Effect
20 – Recreational users	High	Temporary (short-term)	Refer to Section 8.9	Major	Very Large adverse
21 – Recreational users	High	Temporary (short-term)	Refer to Section 8.9	Major	Large adverse
Views from west of Culham Science Centre					
23 – Road users	Low	Temporary (short-term)	Refer to Section 8.9	Major	Moderate adverse
24 – Road users	Low	Temporary (short-term)	Refer to Section 8.9	Major	Moderate adverse
Views from the entrance to Culham Science Centre					
26 – Road users	Low	Temporary (short-term)	Refer to Section 8.9	Major	Moderate adverse
27 - Residents	Medium	Temporary (short-term)	Refer to Section 8.9	Major	Large adverse
28 – Road users	Low	Temporary (short-term)	Refer to Section 8.9	Major	Moderate adverse
Views from around Clifton Hampden					
31 – Recreational users	Medium	Temporary (short-term)	Refer to Section 8.9	Major	Large adverse
32 – Recreational users	Medium	Temporary (short-term)	Refer to Section 8.9	Major	Large adverse
34 – Recreational users	Medium	Temporary (short-term)	Refer to Section 8.9	Major	Large adverse
36 – Recreational users	Medium	Temporary (short-term)	Refer to Section 8.9	Major	Large adverse

Receptor/	Receptor Sensitivity	Impact Description	Design and Mitigation Measures	Impact Magnitude	Residual Effect
36a – Residents	Medium	Temporary (short-term)	Refer to Section 8.9	Major	Large adverse
37 – Recreational users	Medium	Temporary (short-term)	Refer to Section 8.9	Major	Large adverse
38 – Recreational users	Medium	Temporary (short-term)	Refer to Section 8.9	Major	Large adverse
Operation (Year 1)					
Views from Didcot					
7 – Residents	Medium	Temporary (long-term)	Refer to Section 8.9	Moderate	Moderate adverse
Views from south Appleford					
10 – Recreational users	Low	Temporary (long-term)	Refer to Section 8.9	Major	Moderate adverse
10a – Residents	Medium	Temporary (long-term)	Refer to Section 8.9	Moderate	Moderate adverse
10b – Residents	Medium	Temporary (long-term)	Refer to Section 8.9	Moderate	Moderate adverse
Views from the Thames Path National Trail					
18 – Recreational users	High	Temporary (long-term)	Refer to Section 8.9	Moderate	Moderate adverse
19 – Recreational users	High	Temporary (long-term)	Refer to Section 8.9	Major	Very Large adverse
20 – Recreational users	High	Temporary (long-term)	Refer to Section 8.9	Major	Very Large adverse

Receptor/	Receptor Sensitivity	Impact Description	Design and Mitigation Measures	Impact Magnitude	Residual Effect
21 – Recreational users	High	Temporary (long-term)	Refer to Section 8.9	Moderate	Moderate adverse
Views from the entrance to Culham Science Centre					
27 – Residents	Medium	Temporary (long-term)	Refer to Section 8.9	Major	Moderate adverse
Views from around Clifton Hampden					
31 – Recreational users	Medium	Temporary (long-term)	Refer to Section 8.9	Major	Large adverse
32 – Recreational users	Medium	Temporary (long-term)	Refer to Section 8.9	Major	Moderate adverse
34 – Recreational users	Medium	Temporary (long-term)	Refer to Section 8.9	Major	Large adverse
36 – Recreational users	Medium	Temporary (long-term)	Refer to Section 8.9	Major	Large adverse
36a – Residents	Medium	Temporary (long-term)	Refer to Section 8.9	Major	Large adverse
37 – Recreational users	Medium	Temporary (long-term)	Refer to Section 8.9	Major	Large adverse
38 – Recreational users	Medium	Temporary (long-term)	Refer to Section 8.9	Major	Large adverse
Operation (Year 15)					
Views from south Appleford					
10 – Recreational users	Low	Permanent (long-term)	Refer to Section 8.9	Major	Moderate adverse

Receptor/	Receptor Sensitivity	Impact Description	Design and Mitigation Measures	Impact Magnitude	Residual Effect
Views from Thames Path National Trail					
18 – Recreational users	High	Permanent (long-term)	Refer to Section 8.9	Moderate	Moderate adverse
19 – Recreational users	High	Permanent (long-term)	Refer to Section 8.9	Major	Large adverse
20 – Recreational users	High	Permanent (long-term)	Refer to Section 8.9	Major	Large adverse
21 – Recreational users	High	Permanent (long-term)	Refer to Section 8.9	Moderate	Moderate adverse
Views from the entrance to Culham Science Centre					
27 – Residents	Medium	Permanent (long-term)	Refer to Section 8.9	Major	Moderate adverse
Views from around Clifton Hampden					
31 – Recreational users	Medium	Permanent (long-term)	Refer to Section 8.9	Moderate	Moderate adverse
34 – Recreational users	Medium	Permanent (long-term)	Refer to Section 8.9	Major	Moderate adverse
36 – Recreational users	Medium	Permanent (long-term)	Refer to Section 8.9	Moderate	Moderate adverse
36a – Residents	Medium	Permanent (long-term)	Refer to Section 8.9	Moderate	Moderate adverse
37 – Recreational users	Medium	Permanent (long-term)	Refer to Section 8.9	Major	Moderate adverse

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Annex 5 – Chapter 9: Biodiversity



REVISED

Didcot Garden Town HIF 1 Scheme

Environmental Statement

Volume I

Chapter 9 – Biodiversity

October 2022

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9. Biodiversity

9.1 Introduction

- 9.1.1 This chapter of the Environmental Statement (ES) presents the likely significant biodiversity effects as a result of the Housing Infrastructure Fund (HIF1) Scheme on ecology and nature conservation (biodiversity), during construction and operation of the Scheme.
- 9.1.2 This chapter provides a summary of the relevant legislation for biodiversity, outlines the baseline, provides an evaluation of relevant important ecological receptors (including nature conservation designations, priority habitats, protected species and invasive non-native species) associated with the Scheme, with each being assigned a nature conservation value (sensitivity (value)).
- 9.1.3 The potential direct and indirect impacts of the Scheme and effects on ecological receptors and their conservation status, inter-relationships, and their contribution to local (and if appropriate regional and national) biodiversity are identified. This chapter considers impact avoidance design measures and management activities when determining the significance of potential effects. The requirement for any further mitigation measures is then described and mitigation measures are considered in the assessment of potential residual effects.
- 9.1.4 Consultation responses and scoping opinions based on the Environmental Impact Assessment (EIA) Scoping Report for the Scheme) (Ref 9.1) have been taken into account during preparation of this chapter. Consideration is also given to other known projects and activities and specifically to the potential for interaction between the Scheme and other projects resulting in cumulative effects.

Supporting information

- 9.1.5 This chapter is supported by the following technical appendices:
- Appendix 9.1 (2020) – Didcot Garden Town HIF1 Scheme: Preliminary Ecological Appraisal (PEA) Report (and Aquatic Ecology Walkover Surveys);
 - Appendix 9.2 (2021) – Didcot Garden Town HIF 1 – Survey Report for Hedgerows and Arable Plants;
 - Appendix 9.3 (2020) – Didcot Garden Town HIF 1 – Terrestrial Invertebrate Survey Report;
 - Appendix 9.4 (2020) – Didcot Garden Town HIF 1 – Aquatic Ecology Survey Report;
 - Appendix 9.5 (2022) – Didcot Garden Town HIF 1 – Reptile Survey Report;
 - Appendix 9.6 (2022) – Didcot Garden Town HIF 1 – Great Crested Newt Survey Report;
 - Appendix 9.7 (2022) – Didcot Garden Town HIF 1 –Breeding Birds Survey Report;
 - Appendix 9.8 (2021) – Didcot Garden Town HIF1 – Wintering Bird Survey Report;
 - Appendix 9.9 (2020; as amended 2021) – Didcot Garden Town HIF 1 – Bat Survey Report;

- Appendix 9.10 (2020) – Didcot Garden Town HIF 1 – Dormouse Survey Report; and
 - Appendix 9.11 (2020; as amended 2022) – Didcot Garden Town HIF 1 – Otter and Water Vole Survey Report.
- 9.1.6 The survey report for Badger (*Meles meles*) is not included as a technical appendix, owing to the sensitivities of detailing information on the location of Badger setts. This report will be provided separately to key stakeholders.
- 9.1.7 Full details of the survey areas, survey methods (including any specific limitations to surveys), survey dates and guidance used for each survey are available in the appendices as detailed above (Appendices 9.1 to 9.11); a summary of survey findings is provided in this chapter.
- 9.1.8 This biodiversity chapter is also supported by an Outline Landscape and Biodiversity Management Plan (OLBMP) (AECOM, 2022), the purpose of which is to set out the key measures required to avoid, mitigate and compensate for impacts and effects to terrestrial biodiversity and landscape from the construction and operation of the Scheme. The OLBMP will also provide management prescriptions aimed at ensuring the Scheme delivers biodiversity benefits over the long term.
- 9.1.9 An Outline Environmental Management Plan (OEMP) (Appendix 4.2) has been prepared for the Scheme to manage any environmental effects of the Scheme and to demonstrate compliance with environmental legislation. The Principal Contractor (PC) will prepare a Construction Environmental Management Plan (CEMP) which will be based on and incorporate the content and requirements of the OEMP as necessary.
- 9.1.10 Effects on ecological resources from infrastructure projects can arise from direct and indirect impacts upon designated sites, habitats or species, and be of a temporary or permanent nature. Indirect effects can occur through pollution of air and water and via changes in noise or hydrology, and this biodiversity chapter is therefore supported by information contained within the following chapters of the ES:
- ES Chapter 6: Air Quality;
 - ES Chapter 8: Landscape and Visual;
 - ES Chapter 10: Noise and Vibration; and
 - ES Chapter 14: Road Drainage and the Water Environment.
- 9.1.11 This chapter should also be read in conjunction with Chapters 1 to 5 of the ES.

Competent expertise

- 9.1.12 This chapter has been prepared by a competent expert with 15 years relevant and appropriate experience as summarised in Appendix 1.1. The chapter has been reviewed and verified by a Chartered Ecologist and Environmentalist of the Chartered Institute of Ecology and Environmental Management (CIEEM).

9.2 Legislative and policy framework

- 9.2.1 The following sub-sections provide further specific details of the legislation and policies that are of most relevance to the biodiversity assessment, namely where these have informed the identification of receptors and resources and their sensitivity; the assessment method; the potential for significant environmental effects; and required mitigation.

Legislation

The Conservation of Habitats and Species Regulations 2017

- 9.2.2 The Conservation of Habitats and Species Regulations 2017 (Ref 9.2) (the Habitats Regulations) (as amended) transpose the requirements of the EC Habitats Directive (Ref 9.3) and Birds Directive (Ref 9.4) into UK law and provide for the designation and protection of European Sites (and adapt planning and other controls for the protection of these sites). This includes Annex I (including habitats) and Annex II (including species) for which such sites can be designated.
- 9.2.3 The Habitats Regulations (Ref 9.2) also provide protection for certain European Protected Species (EPS) that are listed on Schedule 2 (animals) or Schedule 4 (plants). Provision is made for the granting of licences that permit certain acts as lawful, providing the appropriate authority is satisfied that there is no satisfactory alternative, and the favourable conservation status of the species will be maintained.
- 9.2.4 The latest 2019 amendment to the Habitats Regulations means that Special Areas of Conservation (SACs) and Special Protection Areas (SPAs) in the UK no longer form part of the EU's Natura 2000 ecological network following the UK exit from the EU. The 2019 Regulations have created a national site network on land and at sea, including both the inshore and offshore marine areas in the UK. The national site network includes:
- existing SACs and SPAs; and
 - new SACs and SPAs designated under these Regulations.
- 9.2.5 The presence of European Sites (referred to in this document as designated sites of international importance) and their relationship to the Scheme and the presence of Annex I habitats and Annex II species, and also of any EPS, have been considered within the assessment as presented within this chapter.

Ramsar Convention

- 9.2.6 The Ramsar Convention 1971 (Ref 9.5) is an international treaty which includes the designation of wetlands of international importance. Government policy (Ref 9.2) extends the same level of protection to Ramsar wetlands as that afforded to sites that are designated under the Habitats Directive.
- 9.2.7 **There are no Ramsar sites which are functionally linked to the Scheme.**

Wildlife and Countryside Act 1981

- 9.2.8 The Wildlife and Countryside Act (WCA) 1981 (the Act) (as amended) (Ref 9.6) is a primary piece of UK wildlife legislation, protecting birds, other animals and plants (including vascular plants, bryophytes, lichens and fungi) and allowing for the designation of protected areas including Sites of Special Scientific Interest (SSSIs). The Act also defines a list of invasive non-native species, making it illegal to spread them in the wild.
- 9.2.9 Designated sites, protected flora and fauna, and invasive species covered by the Act that will be affected by the Scheme have been considered in the assessment.

Countryside and Rights of Way Act 2000

- 9.2.10 The Countryside and Rights of Way Act 2000 (Ref 9.7) extends powers relating to the protection and management of SSSIs. This includes powers for entering management agreements, placing a duty on public bodies to further the conservation

and enhancement of SSSIs, increasing penalties for conviction, and appeal processes for the notification, management and protection of SSSIs. It also introduced the offence of ‘reckless’ disturbance of threatened species.

- 9.2.11 The legislative provisions relating to designated sites and flora and fauna affected by the Scheme have been considered in the assessment.

Water Environment (Water Framework Directive (WFD)) (England and Wales) Regulations 2017

- 9.2.12 The EU Water Framework Directive (WFD) (Ref 9.8) is transposed into environmental legislation in England by the Water Environment (WFD) (England and Wales) Regulations 2017 (Ref 9.9). It follows a holistic approach to the sustainable management of water by considering the interactions between surface water (including transitional and coastal waters, rivers, streams and lakes), groundwater and water-dependent ecosystems.
- 9.2.13 The WFD Assessment (AECOM, 2021), in conjunction with the ES, has considered the provisions of the Water Environment (WFD) (England and Wales) Regulations 2017 (Ref 9.9) in relation to avoiding deterioration of a water body from its current status or potential and/ or not preventing future attainment of good status or potential where not already achieved.

Natural Environment and Rural Communities Act 2006

- 9.2.14 Section 40 of the Natural Environment and Rural Communities Act 2006 (Ref 9.10) (NERC Act) places a duty on public authorities in England to conserve biodiversity, which includes restoring or enhancing species populations or habitat.
- 9.2.15 Section 41 of the NERC Act (Ref 9.10) requires the Secretary of State for Environment to publish and maintain a list of habitats and species that are of ‘principal importance’ for the purpose of conserving biodiversity and are regarded as conservation priorities under the UK Post-2010 Biodiversity Framework (Ref 9.11).
- 9.2.16 The occurrence of Habitats and Species of Principal Importance (SPI) has been identified in the assessment through a desk study and field surveys, and the design of the Scheme includes measures for their conservation and enhancement.

Protection of Badgers Act 1992

- 9.2.17 The Protection of Badgers Act 1992 (Ref 9.12) provides specific legislation to protect Badgers from cruelty. The protection of Badgers through best working practices, including the legal requirement for licences from Natural England, where required, has been considered as part of the assessment.

Hedgerow Regulations 1997

- 9.2.18 The Hedgerow Regulations 1997 (Ref 9.13) introduced protection for countryside hedgerows that are defined as ‘important’ because they meet specific wildlife or landscape criteria. The assessment has evaluated hedgerows potentially affected by the Scheme by way of field survey, to determine whether any qualify as important under the ecological criteria.

Salmon and Freshwater Fisheries Act 1975

- 9.2.19 The Salmon and Freshwater Fisheries Act 1975 (Ref 9.14) (as amended) relates to the protection of freshwater fish, including Salmon (*Salmo salar*) and trout species and their habitats.

- 9.2.20 The assessment has considered the provisions of the Salmon and Freshwater Fisheries Act 1975 (Ref 9.14) in relation to the risk of mortality, migration barriers, pollution and the degradation of habitats potentially resulting from the Scheme.

Eels (England and Wales) Regulations 2009

- 9.2.21 The Eels (England and Wales) Regulations 2009 (the Eel Regulations) (Ref 9.15) came into force on 15th January 2010 to support the UK in implementing EC Council Regulation (1100/2007) (the EC Eel Regulations) (Ref 9.16). Under these regulations, action must be taken to halt and reverse the decline in the European Eel (*Anguilla anguilla*) stocks, aiming to meet mature adult Eel biomass escapement targets to sea of 40% relative to that expected in the absence of anthropogenic impacts.
- 9.2.22 The assessment has considered the provisions of the Eel Regulations (Ref 9.15) in relation to safe and unobstructed passage for Eel, and consideration regarding channel alterations, river crossings and culverting.

Animal Welfare Act 2006

- 9.2.23 The Animal Welfare Act 2006 (Ref 9.17) protects vertebrate animals from harm.
- 9.2.24 The provisions of the Animal Welfare Act 2006 (Ref 9.17) have been taken account of within the assessment by ensuring the welfare of any animals potentially affected by the Scheme are considered.

Wild Mammals (Protection) Act 1996

- 9.2.25 The Wild Mammals (Protection) Act 1996 (Ref 9.18) makes it an offence to harm wild mammals with intent to inflict unnecessary suffering.
- 9.2.26 The assessment has considered the requirements of the Wild Mammals (Protection) Act 1996 (Ref 9.18) and includes measures to ensure any risk of unnecessary suffering of wild animals is avoided.

Invasive Alien Species (Permitting and Enforcement) Order 2019

- 9.2.27 The Invasive Alien Species (Enforcement and Permitting) Order 2019 (Ref 9.19) came into effect on 1st December 2019. This allows for the enforcement of the EU Invasive Alien Species Regulation 1143/2014 (Ref 9.19) on the prevention and management of invasive alien plant and animal species in England and Wales, including the relevant licenses, permits and rules for keeping invasive alien species.
- 9.2.28 If an invasive non-native species is not a species of EU concern, then the Wildlife & Countryside Act 1981 (as amended) (Section 14, Schedule 9) (Ref 9.6) may still apply.

National planning policy

- 9.2.29 The National Planning Policy Framework (NPPF) (Ref 9.21), with particular reference to Sections 174 to 182, details the Government's planning policies for England and how these are expected to be applied. The NPPF states that the planning system should contribute to and enhance the natural and local environment by minimising impacts on biodiversity and providing net gains in biodiversity where possible.
- 9.2.30 The NPPF specifies the obligations that Local Authorities and the UK Government have regarding sites statutorily designated for their biodiversity value and protected species under UK and international legislation and how this is to be delivered in the planning system. Protected or notable habitats and species can be a material

consideration in planning decisions and, may therefore, make some sites unsuitable for particular types of development, or if development is permitted, mitigation measures may be required to avoid or minimise impacts on certain habitats and species, or where impact is unavoidable, compensation may be required.

- 9.2.31 The NPPF is clear that pursuing sustainable development includes moving from a net loss of biodiversity to achieving net gains for nature and that a core principle for planning is that it should contribute to conserving and enhancing the natural environment and reducing pollution.

National Planning Practice Guidance

- 9.2.32 The National Planning Practice Guidance (PPG) for the Natural Environment (Ref 9.22) provides context to the NPPF (Ref 9.19) and advises on how the consideration of biodiversity can inform planning decisions.
- 9.2.33 The guidance has been considered by undertaking a desk study and field surveys to define important biodiversity features, evaluating how the Scheme may affect the status of these features with reference to conservation objectives, and by developing mitigation measures with relevant consultees.

Local planning policy

- 9.2.34 Local planning policy has been considered when assessing potential ecological constraints and opportunities identified by the desk study and field surveys; and, when assessing requirements for further survey, design options and ecological mitigation. The local planning policy relevant to the Scheme consists of the following:
- The South Oxfordshire District Council (SODC) Local Plan 2034; and
 - The Vale of White Horse District Council (VoWHDC) Local Plan 2031.
- 9.2.35 For details of these local plans, see Chapter 1: Introduction, of this ES.

Other guidance

- 9.2.36 Other guidance documents relevant to the assessment of the impacts of the Scheme on biodiversity are included below.

Natural England and Department for Environment, Food and Rural Affairs (Defra) Standing Advice (protected species)

- 9.2.37 Standing advice from Natural England and Defra (Ref 9.23) provides guidance on protected and notable species and includes reference to the best practice approaches to survey, mitigation and compensation. Guidance is also provided on the procedure for obtaining protected species licences.
- 9.2.38 This advice has informed the planning of surveys and the approach to mitigating impacts upon protected species, including where necessary the requirement for Natural England mitigation licences.

UK Post-2010 Biodiversity Framework

- 9.2.39 The UK Biodiversity Action Plan (UKBAP) was launched in 1994 (Ref 9.24) and established a framework and criteria for identifying species and habitat types of conservation concern. From this list, action plans for priority habitats and species of conservation concern were published and have subsequently been succeeded by the UK Post-2010 Biodiversity Framework (July 2012) (Ref 9.11). The UK list of 943 priority species and 56 habitats, however, remains an important reference source and

has been used to help draw up statutory lists of priority habitats and species in England, Scotland, Wales and Northern Ireland. For the purpose of this assessment, the UKBAP is still used as one of the criteria to assist in assigning national value to an ecological receptor.

- 9.2.40 The UK Post-2010 Biodiversity Framework is relevant in the context of Section 40 of the NERC Act 2006 (Ref 9.10), meaning that priority species and habitats are material considerations in planning. These habitats and species are identified as those of conservation concern due to their rarity or a declining population trend.
- 9.2.41 The objectives of this framework (Ref 9.11) have been included in the assessment through consideration of habitats and SPIs.

Biodiversity 2020, A strategy for England's wildlife and ecosystem services

- 9.2.42 Biodiversity 2020, A Strategy for England's Wildlife and Ecosystem Services (Ref 9.25) which was published in 2011 sets out the strategic direction for biodiversity policy up to 2020.
- 9.2.43 In accordance with the objectives of the strategy (Ref 9.25), the assessment includes consideration of ecological networks and measures to reduce pressure upon, and enhance, the environment.

Birds of Conservation Concern

- 9.2.44 The Birds of Conservation Concern (BoCC) (Ref 9.26) is an assessment of the conservation status of all regularly occurring British birds. The lists (Red, Amber and Green) indicate the level of conservation importance for each species, derived from quantitative assessments from standardised criteria. The assessment is based on the most up-to-date evidence available and criteria including conservation status at global and European levels and within the UK, historical decline, trends in population and range, rarity, localised distribution and international importance. The lists are compiled by the UK's leading bird conservation organisations, including the Royal Society for the Protection of Birds (RSPB) and British Trust for Ornithology (BTO).

Local Biodiversity Action Plans

- 9.2.45 Local Biodiversity Action Plans relevant to the Scheme are:
- Oxfordshire Biodiversity Action Plan 2015-2020 (Ref 9.27); and
 - Oxfordshire Nature Conservation Forum (ONCF) list of priority habitats and species (Ref 9.28).

Biodiversity Net Gain

- 9.2.46 Biodiversity Net Gain (BNG) is defined as "*development that leaves biodiversity in a better state than before and involves an approach where developers work with local governments, wildlife groups, land owners and other stakeholders in order to support their priorities for nature conservation*" (Ref 9.29).
- 9.2.47 The Environment Bill includes proposals for BNG to become a legal requirement for development. The Government has set itself a timetable for the implementation of the Act's provisions which will be clarified in due course via a further stage of consultation and draft legislation.
- 9.2.48 For a development to achieve BNG, it is important that the principles of the mitigation hierarchy are followed. This process involves first trying to avoid adverse impacts on

biodiversity before finding ways to minimise or mitigate effects, and as a last resort compensating for any residual effects.

9.2.49 The sequential steps that must be taken throughout the lifecycle of a project are:

- Avoidance – actions taken to avoid causing impacts to the environment prior to beginning development (e.g. moving the development to a different location);
- Minimisation – measures taken to reduce the duration, intensity, extent and/ or likelihood of the unavoidable environmental impacts caused by development (e.g. adapting the development design to minimise impacts);
- Restoration or rehabilitation – actions taken to repair environmental degradation or damage following unavoidable impacts caused by development; and
- Offsets – measures taken to compensate for any adverse environmental impacts caused by development which cannot be avoided, minimised and/ or restored (e.g. including habitat creation to offset losses).

9.2.50 Biodiversity metrics provide a measure of overall biodiversity value based on habitat type, area, condition and distinctiveness. A metric is a tool that allows a value to be measured, in this case biodiversity, which is calculated pre- and post-development. The change in biodiversity units indicates either a net loss, a net gain or no change in biodiversity.

9.3 Consultation with relevant stakeholders

Scope of the assessment

9.3.1 The legislation and planning policy described in Section 9.2 and within the Preliminary Ecological Appraisal (PEA) Report (see Appendix 9.1) have informed the impact assessment methods.

9.3.2 An EIA Scoping Opinion Request was submitted by Oxfordshire County Council (OCC) (as the promoter) to OCC in its capacity as the Local Planning Authority (LPA) in April 2020, which sought the opinion of the LPA regarding the approach for the assessment of environmental effects resulting from the construction and operation of the Scheme. In accordance with the EIA Regulations, the LPA consulted statutory stakeholders where they considered it applicable.

9.3.3 The scoping opinions received in relation to biodiversity are collated in Table 9.1 along with the responses.

Table 9.1: Scoping Opinion and response

Scoping Opinion	Where addressed within the ES Chapter
Natural England	
Biodiversity and Geology: Natural England advises that the potential impact of the proposal upon features of nature conservation interest and opportunities for habitat creation/enhancement should be included within this assessment in accordance with appropriate guidance on such matters. Guidelines for Ecological Impact Assessment (EclA) have been developed by the Chartered Institute of Ecology and Environmental Management (CIEEM) and are available on their website. EclA is the process of identifying, quantifying and evaluating the potential impacts of defined actions on ecosystems or their components. EclA may be carried out as part of the EIA process or to support other forms of environmental	Sections 9.2 and 9.4 of this chapter.

Scoping Opinion	Where addressed within the ES Chapter
<p>assessment or appraisal.</p> <p>The National Planning Policy Framework sets out guidance in S.174-177 on how to take account of biodiversity interests in planning decisions and the framework that local authorities should provide to assist developers.</p>	
<p>The ES should thoroughly assess the potential for the proposal to affect designated sites. European sites (e.g. designated Special Areas of Conservation and Special Protection Areas) fall within the scope of the Conservation of Habitats and Species Regulations 2017 (as amended). In addition, paragraph 176 of the National Planning Policy Framework requires that potential Special Protection Areas, possible Special Areas of Conservation, listed or proposed Ramsar sites, and any site identified as being necessary to compensate for adverse impacts on classified, potential or possible SPAs, SACs and Ramsar sites be treated in the same way as classified sites.</p> <p>Under Regulation 63 of the Conservation of Habitats and Species Regulations 2017 (as amended) an appropriate assessment needs to be undertaken in respect of any plan or project which is (a) likely to have a significant effect on a European site (either alone or in combination with other plans or projects) and (b) not directly connected with or necessary to the management of the site.</p> <p>Should a Likely Significant Effect on a European/Internationally designated site be identified or be uncertain, the competent authority (in this case the Local Planning Authority) may need to prepare an Appropriate Assessment, in addition to consideration of impacts through the EIA process.</p> <p>Sites of Special Scientific Interest (SSSIs) and sites of European or international importance (Special Areas of Conservation, Special Protection Areas and Ramsar sites)</p> <p>The development site is near to the following designated nature conservation sites:</p> <ul style="list-style-type: none"> • Little Wittenham SAC • Culham Brake SSSI <p>Further information on the SSSI and its special interest features can be found at www.magic.gov. The Environmental Statement should include a full assessment of the direct and indirect effects of the development on the features of special interest within these sites and should identify such mitigation measures as may be required in order to avoid, minimise or reduce any adverse significant effects.</p> <p>Little Wittenham SAC - European site conservation objectives are available on our internet site. http://publications.naturalengland.org.uk/category/6490068894089216</p>	<p>Section 9.7 of this chapter.</p>
<p>Regionally and Locally Important Sites:</p> <p>The EIA will need to consider any impacts upon local wildlife and geological sites. Local Sites are identified by the local wildlife trust, geo-conservation group or a local forum established for the purposes of identifying and selecting local sites. They are of county importance for wildlife or geodiversity. The Environmental Statement should therefore include an assessment of the likely impacts on the wildlife and geodiversity interests of such sites. The assessment should</p>	<p>Section 9.7 of this chapter.</p>

Scoping Opinion	Where addressed within the ES Chapter
<p>include proposals for mitigation of any impacts and if appropriate, compensation measures. Contact the local wildlife trust, geo-conservation group or local sites body in this area for further information.</p>	
<p>Protected Species - Species protected by the Wildlife and Countryside Act 1981 (as amended) and by the Conservation of Habitats and Species Regulations 2017 (as amended):</p> <p>The ES should assess the impact of all phases of the proposal on protected species (including, for example, great crested newts, reptiles, birds, water voles, badgers and bats). Natural England does not hold comprehensive information regarding the locations of species protected by law but advises on the procedures and legislation relevant to such species. Records of protected species should be sought from appropriate local biological record centres, nature conservation organisations, groups and individuals; and consideration should be given to the wider context of the site for example in terms of habitat linkages and protected species populations in the wider area, to assist in the impact assessment.</p> <p>The conservation of species protected by law is explained in Part IV and Annex A of Government Circular 06/2005 Biodiversity and Geological Conservation: Statutory Obligations and their Impact within the Planning System. The area likely to be affected by the proposal should be thoroughly surveyed by competent ecologists at appropriate times of year for relevant species and the survey results, impact assessments and appropriate accompanying mitigation strategies included as part of the ES.</p> <p>In order to provide this information, there may be a requirement for a survey at a particular time of year. Surveys should always be carried out in optimal survey time periods and to current guidance by suitably qualified and where necessary, licensed, consultants. Natural England has adopted standing advice for protected species which includes links to guidance on survey and mitigation.</p>	<p>Details of surveys undertaken are summarised in Section 9.7, with survey reports provided in Appendices 9.2 to 9.12.</p>
<p>Habitats and Species of Principal Importance:</p> <p>The ES should thoroughly assess the impact of the proposals on habitats and/or species listed as 'Habitats and Species of Principal Importance' within the England Biodiversity List, published under the requirements of S41 [Section 41] of the Natural Environment and Rural Communities (NERC) Act 2006. Section 40 of the NERC Act 2006 places a general duty on all public authorities, including local planning authorities, to conserve and enhance biodiversity. Further information on this duty is available here https://www.gov.uk/guidance/biodiversity-duty-public-authority-duty-to-have-regard-to-conserving-biodiversity.</p> <p>Government Circular 06/2005 states that Biodiversity Action Plan (BAP) species and habitats, 'are capable of being a material consideration...in the making of planning decisions.' Natural England therefore advises that survey, impact assessment and mitigation proposals for Habitats and Species of Principal Importance should be included in the ES. Consideration should also be given to those species and habitats included in the relevant Local BAP.</p> <p>Natural England advises that a habitat survey (equivalent to Phase 2) is carried out on the site, in order to identify any important habitats present. In addition, ornithological,</p>	<p>The biodiversity method as described in the Scoping Report has been used and detailed in Section 9.4.</p>

Scoping Opinion	Where addressed within the ES Chapter
<p>botanical and invertebrate surveys should be carried out at appropriate times in the year, to establish whether any scarce or priority species are present. The Environmental Statement should include details of:</p> <ul style="list-style-type: none"> Any historical data for the site affected by the proposal (e.g. from previous surveys); Additional surveys carried out as part of this proposal; The habitats and species present; The status of these habitats and species (e.g. whether priority species or habitat); The direct and indirect effects of the development upon those habitats and species; Full details of any mitigation or compensation that might be required. <p>The development should seek if possible, to avoid adverse impact on sensitive areas for wildlife within the site, and if possible, provide opportunities for overall wildlife gain.</p> <p>The record centre for the relevant Local Authorities should be able to provide the relevant information on the location and type of priority habitat for the area under consideration.</p>	
<p>Contacts for Local Records:</p> <p>Natural England does not hold local information on local sites, local landscape character and local or national biodiversity priority habitats and species. We recommend that you seek further information from the appropriate bodies (which may include the local records centre, the local wildlife trust, local geo-conservation group or other recording society and a local landscape characterisation document).</p>	Section 9.4 of this chapter.
<p>Air Quality:</p> <p>Air quality in the UK has improved over recent decades but air pollution remains a significant issue; for example, over 97% of sensitive habitat area in England is predicted to exceed the critical loads for ecosystem protection from atmospheric nitrogen deposition (England Biodiversity Strategy, Defra 2011). A priority action in the England Biodiversity Strategy is to reduce air pollution impacts on biodiversity. The planning system plays a key role in determining the location of developments which may give rise to pollution, either directly or from traffic generation, and hence planning decisions can have a significant impact on the quality of air, water and land. The assessment should take account of the risks of air pollution and how these can be managed or reduced. Further information on air pollution impacts and the sensitivity of different habitats/designated sites can be found on the Air Pollution Information System (www.apis.ac.uk). Further information on air pollution modelling and assessment can be found on the Environment Agency (EA) website.</p>	ES Chapter 6: Air Quality
<p>Climate Change Adaptation:</p> <p>The England Biodiversity Strategy published by Defra establishes principles for the consideration of biodiversity and the effects of climate change. The ES should reflect these principles and identify how the development's effects on the natural environment will be influenced by climate change, and how ecological networks will be maintained. The NPPF requires that the planning system should contribute to the enhancement of the natural environment 'by establishing</p>	ES Chapter 15: Climate

Scoping Opinion	Where addressed within the ES Chapter
coherent ecological networks that are more resilient to current and future pressures' (NPPF Para 174), which should be demonstrated through the ES.	
<p>Ancient Woodland:</p> <p>The S41 [Section 41] list includes six priority woodland habitats, which will often be ancient woodland, with all ancient semi-natural woodland in the South East falling into one or more of the six types. Information about ancient woodland can be found in Natural England's standing advice http://www.naturalengland.org.uk/Images/standing-advice-ancient-woodland_tcm6-32633.pdf.</p> <p>Ancient woodland is an irreplaceable resource of great importance for its wildlife, its history and the contribution it makes to our diverse landscapes. Local authorities have a vital role in ensuring its conservation, in particular through the planning system. The ES should have regard to the requirements under the NPPF (Para. 175)² which states:</p> <p>When determining planning applications, local planning authorities should apply the following principles:</p> <p>a) if significant harm to biodiversity resulting from a development cannot be avoided (through locating on an alternative site with less harmful impacts);</p> <p>c) development resulting in the loss or deterioration of irreplaceable habitats (such as ancient woodland and ancient or veteran trees) should be refused, unless there are wholly exceptional reasons, and a suitable compensation strategy exists.</p>	The Scheme will not impact on ancient woodland.
Oxfordshire County Council	
Overall, I agree with the conclusions of the Scoping Report that a separate ecology chapter will be required and am satisfied with the assessment criteria outlined.	No further comment.
Full details of all Phase 1 and 2 species and habitat surveys shall be provided within the Ecology Chapter, including the scheme boundary and zone of influence. Ecological assessment shall also include all ancillary areas, such as construction compounds. The Chapter will identify protected, notable and priority species, designated sites, important habitats and any other notable biodiversity features which may be directly or indirectly impacted.	The results from the species and habitat surveys are included in the baseline assessment for the ES. The reports of the surveys are also appended to the ES.
<p>Habitat and species surveys should be undertaken in accordance with prevailing best practice guidance and carried out by suitably qualified personnel. The Chapter will include a desk study, with data obtained from the Thames Valley Environmental Records Centre (TVERC). The EIA should answer the following questions:</p> <ul style="list-style-type: none"> • What species or habitats are involved; • What is the population level (or area) likely to be affected by the proposal; • What are the direct and indirect impacts of the proposal on Species or Habitats of Principal Importance; • Is the impact necessary or acceptable, in consideration of the 'avoid, mitigate, compensate' hierarchy; • What can be done to mitigate the impact; and • Will a license be required from Natural England? <p>The Chapter will state whether the proposed works have the potential to impact on a European Protected Species and</p>	Section 9.4 herein confirms the method used to assess biodiversity impacts and effects, whilst the results of the assessment are detailed in Section 9.2.

Scoping Opinion	Where addressed within the ES Chapter
<p>result in an offence under The Conservation of Habitats and Species (Amendment) (EU Exit) Regulations 2019. If an offence is likely, the applicant will need a licence from Natural England and OCC must consider whether a licence is likely to be obtained before granting planning permission. It must be noted that protected species surveys are typically valid for 12 months.</p> <p>An assessment of any potential impacts on statutory and non-statutory designated sites of nature conservation value shall be undertaken. Notably, an assessment of likely significant effects on the Little Wittenham Special Area of Conservation is required. Should any likely significant effect on the interest features of the SAC be identified at the screening stage, for example hydrological impacts, an Appropriate Assessment shall be undertaken.</p>	
<p>Great Crested Newt</p> <p>Great Crested Newt is known to be present within the zone of influence of the Scheme. Oxfordshire County Council now holds a District Level Licence in respect of Great Crested Newts. The NatureSpace scheme is therefore now available developers and operators applying for 'county-level' planning permissions across Oxfordshire. Further detailed advice about the suitability of the scheme in respect of the proposed development can be found at https://naturespaceuk.com/.</p>	<p>Details regarding Great Crested Newt are detailed in Section 9.7 of this chapter.</p>
<p>Biodiversity Net Gain</p> <p>The scheme shall demonstrate that a measurable net gain in biodiversity will be achieved, in accordance with local and national planning policy.</p> <p>This shall be calculated using a biodiversity accounting metric; at the time of writing, the recommended calculator is the Defra 2.0 metric.</p> <p>Impacts within the scheme area should in the first instance be minimised wherever possible, however where this is not possible and a net loss in biodiversity is achieved, off-site compensation will be required.</p> <p>While no set percentage for biodiversity net gain is currently provided within local or national policy, the upcoming Environment Bill is expected to request a minimum of 10% biodiversity net gain. The proposed scheme should therefore achieve a minimum 10% net gain in biodiversity, providing a meaningful contribution to local nature recovery. It is expected that the management of any biodiversity off-set areas will be guaranteed for a minimum of 25 years.</p>	<p>A biodiversity value assessment has been undertaken in accordance with guidance from the Department for Environment, Food & Rural Affairs as a stand-alone exercise for Planning.</p>
Environment Agency	
<p>We are pleased to see reference within the report to a habitat conditions assessment to inform biodiversity net-gain. A key element of the Defra 25-year Environment Plan is to establish nature recovery networks. Parts of the scheme affect the Thames floodplain which forms part of one such network, of which South Oxfordshire District Council and Oxfordshire County Council have had some involvement in. The outputs of this study should be incorporated into the ES and we request that the scoping report is revised to account for this.</p>	<p>A biodiversity condition assessment has been undertaken (in accordance with guidance from the Department for Environment, Food & Rural Affairs) as a stand-alone exercise, including specific metrics pertaining to the water environment. This will be presented with the planning submission.</p>
South Oxfordshire District Council & Vale of White Horse District Council	
<p>There is general agreement with the scoping report regarding the scoping in of biodiversity as part of the EIA. The technical</p>	<p>All technical matters mentioned in the Scoping Report and raised by</p>

Scoping Opinion	Where addressed within the ES Chapter
matters which are mentioned in the scoping report, and raised by Natural England in their response, will need to be given full consideration. The report states that a biodiversity net gain assessment will take place. It is recommended that Defra's Biodiversity Metric 2.0 is used for the assessment (referring to the user guide and technical supplements). OCC [Oxfordshire County Council] should commit to a net gain figure for these works. It is recommended that in line with the Environment Bill standards, that OCC commit to delivering a minimum of 10% net gain of biodiversity resource across the development.	Natural England have been taken into consideration during the EIA and during the preparation of this ES.

9.3.4 In addition to the matters raised in the scoping opinion, the final assessment scope has also been shaped by the following:

- Design changes made to the Scheme in respect of its form and extent, and the area of land required for its construction, operation and maintenance;
- The outcomes of consultation with statutory and non-statutory bodies, and other stakeholders with an interest in ecology and nature conservation; and
- The outcomes of further desk-based studies and field surveys undertaken to establish the baseline conditions associated with the ecological environment and to inform the identification of the likely significant effects of the Scheme.

9.3.5 Subsequent to receipt of the Scoping Opinion, two ecology workshops were held with the EA, Natural England, OCC ecologists and environmental specialists on 11th September 2020 and 26th February 2021. The purpose of the workshops was to agree the scope for the surveys and the ecological assessment, share the findings of the surveys and discuss opportunities for mitigation, compensation, and enhancement where the Scheme will likely impact biodiversity. The BNG target for the Scheme was also discussed.

9.4 Assessment method

9.4.1 The assessment of potential biodiversity impacts associated with the construction and operation of the Scheme is based upon the method set out within the Guidelines for Ecological Impact Assessment in the UK and Ireland published by CIEEM in 2019 (Ref 9.31), whilst also giving consideration to Guidance in the Design Manual for Roads and Bridges (DMRB) LA 108: Biodiversity (Ref 9.30).

9.4.2 The method also draws upon specific species technical assessment guidance, where applicable, which are appropriately referenced, as well as professional judgement.

Establishment of the baseline conditions

9.4.3 Establishment of the baseline environment involved reference to existing data sources, consultation with statutory bodies and other organisations and fieldwork surveys.

Sources of information

9.4.4 A desk study was undertaken in December 2019 to identify sites designated for their biodiversity value, and the review of records of protected and notable habitats and species (biodiversity features) and invasive non-native species potentially relevant to the Scheme.

9.4.5 The desk study search was conducted from the Scheme boundary (the Site) and included a search for:

- sites of international conservation value (e.g. Special Areas of Conservation (SACs), Special Protection Areas (SPAs) and Ramsar sites) within 10 km of the Scheme boundary as well as any Special Areas of Conservation (SACs) within 30 km where bats are noted as the or one of the qualifying features;
- sites statutorily designated for their national nature conservation value (e.g. Sites of Special Scientific Interest (SSSIs) and Local Nature Reserves (LNRs)) within 2 km of the Scheme boundary; and
- sites non-statutorily designated for their conservation value (e.g. Local Wildlife Sites (LWSs)) within 2 km of the Scheme boundary.

9.4.6 The Thames Valley Environmental Records Centre (TVERC) was contacted in December 2019 to gain information on existing ecological information (e.g. records of protected and notable species and habitats within 2 km of the Scheme boundary as well as any scheduled invasive non-native species). Fish, macroinvertebrate and macrophyte (aquatic plant) species records were obtained from the EA Freshwater Fish Survey Database (NFPD) via Ecology and Fish Data Explorer.

9.4.7 In addition, online data resources were reviewed including:

- Multi-Agency Geographic Information Centre (MAGIC) (Ref 9.32);
- Joint Nature Conservation Concern (JNCC) website (Ref 9.33) for details of statutory designated sites including site information and designation details;
- National Biodiversity Network (NBN) Gateway (Ref 9.34); and
- review of third-party reports for other relevant developments in the area, including unpublished ecology monitoring reports from Hanson and FCC.

9.4.8 Relevant information was sought on species included on any of the following statutes or lists:

- Schedules 1, 5 and 8 of the Wildlife & Countryside Act 1981 (as amended) (Ref 9.6); Schedules 2, 4 and 5 of the Habitat Regulations (Ref 9.2); and species and habitats of principal importance for nature conservation in England listed under Section 41 of the NERC Act (Ref 9.10). Other habitats and species were also considered and were assessed on a case-by-case basis, e.g. those included in national, regional or local Red Data Books and Lists but not protected by legislation. This is consistent with the requirements of relevant planning policy; and
- Records of invasive non-native species, as listed under Schedule 9 of the Wildlife & Countryside Act 1981, as amended (Ref 9.6) and Schedule 2 of the Invasive Alien Species (Enforcement and Prohibition) Order 2019 (Ref 9.19), were also collated and have been taken into account when assessing the potential ecological effects of the Scheme.

Field surveys

9.4.9 The requirement for ecological field surveys was determined following completion of the PEA (refer to Appendix 9.1), undertaken in January 2020 and was updated accordingly through 2020 and between January and May 2021, to reflect changes in the Scheme boundary.

9.4.10 The PEA consisted of four components: the desktop study data review; a Phase 1 Habitat survey; a walkover to assess the quality of aquatic habitats in local

watercourses within 1 km of the Scheme; and a scoping survey for protected species and other species of conservation concern.

- 9.4.11 The Phase 1 Habitat survey followed the standard JNCC method '*Handbook for Phase 1 habitat survey: A technique for environmental audit*' (Ref 9.35). In summary, this comprised walking over the habitat within the Scheme boundary and recording the habitat types and boundary features present.
- 9.4.12 The aquatic scoping survey (included within Appendix 9.1) was used to assess the potential for water bodies to support protected or notable species and inform further survey work.
- 9.4.13 A protected species scoping survey was carried out in conjunction with the Phase 1 Habitat survey. This led to the recommendation of field surveys for certain protected or notable habitats and species (see Appendices 9.1 to 9.12), which are presented in Table 9.2. Incidences of invasive non-native species were recorded throughout the various surveys.

Data required to calculate the biodiversity net gain (BNG), net loss or no change were collected during the extended Phase 1 Habitat survey and subsequent surveys, such as the river morphology survey and the hedgerow survey to ensure a comprehensive baseline of habitat data. Table 9.2: Biodiversity field surveys completed

Survey and relevant technical appendix	Survey Area (see Section 6)	Survey Method	Date of Survey Period
Aquatic scoping surveys (Appendix 9.1)	All water bodies identified within the Scheme boundary and up to 1 km from the Scheme boundary, where access was available.	Walking accessible and safe stretches of water body banks, noting physical habitat features such as riparian cover, channel substrate, habitat type, modifications and in-stream vegetation to assess the potential for water bodies to support protected or notable species and inform further survey work (Ref 9.37 & 9.38).	November and December 2019
Phase 1 Habitat survey (Appendix 9.1)	Main habitats within Scheme boundary and to a maximum of 50 m from the Scheme boundary, where access was available.	Walking over and recording the habitat types and boundary features present following the standard method ' <i>Handbook for Phase 1 habitat survey: A technique for environmental audit</i> ' (JNCC, 2010) (Ref 9.35).	Commenced in January 2020, with updates to habitats within the Site, due to changes to the Scheme boundary, made throughout 2020.
River Habitat Survey (RHS) (Appendix 9.4)	All watercourses identified during the aquatic scoping survey and desk study for further survey within the Scheme boundary and up to 1 km from the Scheme boundary, where access was available.	Surveying a standard 500 m stretch of river channel in each watercourse with observations (including natural and artificial features, and channel measurements) made at ten equally spaced 'spot-checks' by an accredited surveyor.	June 2020
Terrestrial habitats and arable flora	The areas of terrestrial habitat surveyed were identified from the initial	Surveying for arable flora involved walking field boundaries and comparable areas of	May and July 2020

Survey and relevant technical appendix	Survey Area (see Section 6)	Survey Method	Date of Survey Period
(Appendix 9.3)	PEA (Phase 1 Habitat survey and desk study) information. The survey area was the Scheme boundary plus a 50 m survey buffer, where access was available.	marginal habitat to record notable species. Lists of rare or scarce arable plant species were recorded for each field surveyed based on Plantlife's Important Arable Plant Areas Outstanding Assemblages (Criterion B) (Ref 9.36).	
Hedgerows (Appendix 9.2)	Hedgerows within the Scheme boundary.	Surveying selected hedgerows subject to potential impacts, assessing their 'importance' against the Wildlife and Landscape Criteria, detailed in the Hedgerow Regulations (Ref 9.13).	May and July 2020
Terrestrial invertebrates including invasive non-native species (Appendix 9.3)	The survey area was the Scheme boundary plus a 50 m survey buffer, where access was available. The areas of terrestrial habitat surveyed were identified from the initial Phase 1 Habitat survey (Appendix 9.1) and desk study information including satellite imagery.	Surveying terrestrial habitats through three seasonal survey visits and evaluating the potential of those habitats to support protected or notable terrestrial invertebrates. Undertaking sweep netting followed by direct searching in areas of the most suitable habitats.	June to September 2020
Aquatic macrophytes including invasive non-native plant species (Appendix 9.4)	Water bodies identified during the aquatic scoping survey and desk study for further survey within the Scheme boundary and up to 1 km from the Scheme boundary, where access was available.	Surveying of watercourses and ditches following the aquatic macroinvertebrate sampling procedures standardised by the Environment Agency (Environment Agency, 2014) (Ref 9.40) and surveying of deeper water following Environment Agency guidance on airlift sampling (Ref 9.40). Surveying ponds and lakes following guidance published by the Freshwater Habitats Trust guide to monitoring the ecological quality of ponds and canals using PSYM (Ref 9.39 & 9.41).	July to September 2020
Aquatic macro-invertebrates including invasive non-native invertebrate species (Appendix 9.4)	Water bodies identified during the scoping walkover and desk study for further survey within the Scheme boundary and up to 1 km from the Scheme boundary, where access was available.	Surveying of watercourses and ditches following the aquatic macroinvertebrate sampling procedures standardised by the EA (EA, 2014) (Ref 9.40) and surveying of deeper water following EA guidance on airlift sampling (Ref 9.39 & 9.41). Surveying ponds and lakes following guidance published by the Freshwater Habitats Trust guide to monitoring the	March to September 2020

Survey and relevant technical appendix	Survey Area (see Section 6)	Survey Method	Date of Survey Period
		ecological quality of ponds and canals using PSYM (Ref 9.41).	
Fish including invasive non-native fish species (Appendix 9.4)	Five water bodies identified during the scoping walkover and desk study for further survey within the Scheme boundary and up to 1 km from the Scheme boundary, where access was available.	Surveying using eDNA analysis of water samples following best practice guidance provided by NatureMetrics (2020) (Ref 9.42).	March, May and July 2020
Reptiles (Appendix 9.5)	Scheme boundary and up to 50 m from the Scheme boundary, where access was available. The survey area included suitable terrestrial habitat for reptiles within the Scheme boundary, which included ephemeral/short perennial vegetation, scrub edges, semi-improved grassland and ditches. A total of 11 areas (collectively referred to as the survey area) of suitable reptile habitat were identified within the Scheme boundary.	Recording reptile species using artificial refugia in accordance with Froglife's Advice Sheet 10 for Reptile Surveys (Froglife, 1999) (Ref 9.43) and Natural England's Standing Advice Sheet for Reptiles (Natural England, 2015) (Ref 9.44).	September 2020
Great Crested Newt (Appendix 9.6)	All potentially suitable aquatic habitat such as ponds and other water bodies within the Scheme boundary and up to 500 m from the Scheme boundary, where access was available.	Surveying comprised: - Habitat Suitability Index (HSI) surveys for 32 ponds / water bodies following the method developed by Oldham <i>et al.</i> (2000) (Ref 9.45) - eDNA samples taken and analysed for 13 ponds and other water bodies, strictly adhering to the standard survey technique for eDNA (Biggs, 2014) (Ref 9.46). Great Crested Newt presence or absence and population size surveys used and - standard field survey techniques to determine presence or absence (and population size, if required) used for 17 ponds / water bodies using torch, bottle-trapping and egg searching methods as recommended by Natural England (English Nature, 2001) (Ref 9.47)	HSI – March to May 2020 eDNA - June 2020 Presence or absence and population surveys - April to May 2020
Breeding Birds	Scheme boundary and up to 100 m from the Scheme	Surveying of breeding birds based on a standard territory	General breeding bird

Survey and relevant technical appendix	Survey Area (see Section 6)	Survey Method	Date of Survey Period
(Appendix 9.7)	boundary, where access was available for the general breeding bird assemblage. Scheme boundary and up to 500 m from the Scheme boundary, where access was available for specific species including Red Kite <i>Milvus</i> , Peregrine Falcon <i>Falco peregrinus</i> , Hobby <i>Falco subbuteo</i> and Barn Owl <i>Tyto alba</i> .	mapping method for surveying breeding birds as detailed in ' <i>Bird Monitoring Methods</i> ' (Gilbert <i>et al.</i> , 1998) (Ref 9.48) and ' <i>Bird Census Techniques</i> ' (Bibby <i>et al.</i> , 2000) (Ref 9.49). Surveying for specially protected species using species-specific methods including Barn Owl following ' <i>Barn Owl Tyto alba Survey Methodology and Techniques for use in Ecological Assessment</i> ' (2011) (Ref 9.50) and Red Kite (Ref 9.48).	assemblage - April to June 2020 Species-specific surveys – March to August 2020
Wintering (non-breeding) birds (Appendix 9.8)	Scheme boundary and up to 100 m from the Scheme boundary, where access was available.	Surveying utilising transect-based walkovers following method detailed in ' <i>Bird Monitoring Methods</i> ' (Gilbert <i>et al.</i> , 1998) (Ref 9.48) and ' <i>Bird Census Techniques</i> ' (Bibby <i>et al.</i> , 2000) (Ref 9.49).	November 2019 to March 2020; and November 2020 to March 2021 to reflect Scheme changes.
Bats (Appendix 9.9)	Scheme boundary and up to 100 m from the Scheme boundary, where access was available.	Undertaking a preliminary roost assessment (PRA) of buildings and other structures and mature trees, following guidance as described in the Bat Conservation Trust (BCT) ' <i>Bat Surveys for Professional Ecologists: Good Practice Guidelines 3rd Edition</i> ' (Collins, J. (editor), 2016) (Ref 9.51). Following this, surveying trees and buildings with potential to support roosting bats based on standard method for bat emergence/ re-entry surveys as described in the BCT guidelines (Collins, 2016) (Ref 9.51). Undertaking bat activity transect and static detector surveys following standard methods as described in the BCT guidelines (Collins, 2016) (Ref 9.51). Undertaken crossing point surveys to record activity along selected commuting features based on Berthinussen & Altringham (2012) (Ref 9.52).	April to October 2020
Hazel Dormouse (Appendix 9.10)	Scheme boundary and up to 50 m from the Scheme boundary, where access was available.	Surveying using nest tube surveys and nut searches within suitable habitat, following methods as described in the <i>Dormouse Conservation Handbook</i> (Ref 9.53) following a desk assessment to appraise the	June to November 2020

Survey and relevant technical appendix	Survey Area (see Section 6)	Survey Method	Date of Survey Period
		suitability of woodland and hedgerows habitats.	
Badger	Scheme boundary and up to 500 m from the Scheme boundary, where access was available.	Walking over and searching for signs of Badger activity as described in the Mammal Society publication, <i>Surveying Badgers</i> (Harris <i>et al.</i> , 1989) (Ref 9.54), and in the <i>National Badger Survey methodology</i> (Cresswell <i>et al.</i> , 1990) (Ref 9.55). Further surveying to determine the extent of Badger territories associated with 'main' setts following bait marking methods outlined by Delahay <i>et al.</i> (2000) (Ref 9.56).	March 2020 and December 2020 with subsequent updates throughout 2020 and in 2021 to reflect Scheme changes. Bait marking surveys undertaken between February and March 2021.
Riparian mammals – Water Vole, Otter (including invasive non-native species, such as Mink <i>Mustela vison</i>) (Appendix 9.11)	All water bodies and watercourses, identified from Ordnance Survey maps, aerial photography, site walkovers and Phase 1 Habitat survey mapping as being potentially suitable for Water Vole and Otter within the Scheme boundary and up to 500 m (Water Vole) and 2 km (Otter) from the Scheme boundary, where access was available.	Searching watercourses for signs of Water Vole activity as described by Strachan <i>et al.</i> , (2011) (Ref 9.57) and Dean <i>et al.</i> , (2016) (Ref 9.58). <i>New Rivers and Wildlife Handbook</i> (RSPB, NRA & RSNC, 1994) (Ref 9.59) and for Otter following the EA's <i>Fifth Otter Survey of England 2009-2010</i> (EA, 2010) (Ref 9.60), ' <i>Monitoring the Otter</i> ' (Chanin, 2003) (Ref 9.61) and with reference to the DMRB Vol 10 Section 4 Part 4 (Ref 9.62).	Water Vole – April to June; and July to September 2020 Otter - April to September 2020
River MoRPh Survey	River Thames and Moor Ditch at crossing locations	A field survey that characterises the local physical structure of a river channel and its margins at a scale that complements biological surveys. The survey is typically conducted over a river length of 10 to 40 m. Data are entered into the MoRPh database by trained surveyors. Fourteen numerical indicators are extracted from the survey data and can be mapped and downloaded along with the raw data. Survey enables River Condition Assessment to inform Rivers Metric calculations for BNG assessment.	Moor Ditch – November 2020 River Thames – February 2020
Water quality and invasive non-native species survey	RWE western lagoon, which will require decommissioning and removal	Water quality was monitored as per the method detailed in ES Chapter 14: Road Drainage and the Water Environment. A walkover survey and aquatic sampling were completed for aquatic and riparian invasive	November 2020

Survey and relevant technical appendix	Survey Area (see Section 6)	Survey Method	Date of Survey Period
		non-native species within and around the lagoon. Sampling for aquatic plants was undertaken with a grapnel, and sweep sampling for macroinvertebrates. Samples were sorted and identified on the bankside with laboratory confirmation of specimens where required.	

Biodiversity importance (value)

- 9.4.14 The importance or value of biodiversity features (comprising designated sites, habitats, species assemblages and populations of species) has been assessed with reference to their:
- biodiversity status (which relates to rarity and threat status);
 - conservation value (which relates to the need to conserve representative areas of different habitats and the genetic diversity of species populations); and
 - legal status (i.e. whether they are afforded protection under legislation).
- 9.4.15 The aims of the biodiversity assessment are to:
- identify relevant biodiversity features (i.e. designated sites, habitats, species or ecosystems) which may be impacted;
 - provide a scientifically rigorous and transparent assessment of the likely impacts on biodiversity and resultant effects of the Scheme: impacts and effects may be positive or negative;
 - facilitate scientifically rigorous and transparent determination of the consequences of the Scheme in terms of national, regional and local policies relevant to nature conservation and biodiversity, where the level of detail provided is proportionate to the scale of the development and the complexity of its potential impacts; and
 - set out what steps will be taken to adhere to legal requirements relating to the relevant biodiversity features concerned.
- 9.4.16 The geographical frames of reference used in this chapter to determine importance, which are based on Section 4.7 in the CIEEM guidelines (Ref 9.31), are:
- International or European (generally this is within a European context, reflecting the general availability of good data to allow cross-comparison);
 - UK or National (Great Britain, but considering the potential for certain biodiversity features to be more notable (of higher value) in England, with context relative to Great Britain as a whole);
 - Regional (Southern England);
 - County (Oxfordshire);
 - District (South Oxfordshire and the Vale of White Horse);
 - Local (within approximately 5 km of the Site); and
 - Negligible (low or no biodiversity value).
- 9.4.17 The importance of biodiversity features does not necessarily equate directly to their sensitivity. For example, a biodiversity feature of high importance may comprise a robust ecosystem which is resilient to effects caused by external factors and is therefore not highly sensitive. Conversely, a biodiversity feature may be highly sensitive to change, but widespread or abundant at the geographic scale considered and therefore the population within the Scheme boundary may not be important at that scale.
- 9.4.18 The criteria applied in the assessment to determine importance are presented in Table 9.3 and have been developed from the criteria contained within DMRB LA 108 (Ref 9.30), with additional criteria applied from the CIEEM guidelines (Ref 9.31), where appropriate.

Table 9.3: Criteria for assessing the importance of features

Importance	Criteria
International (European)	<p>Habitats: European sites including Sites of Community Importance (SCIs); Special Protection Areas (SPAs); potential SPAs (pSPAs); Special Areas of Conservation (SACs); candidate or possible SACs (cSACs or pSACs); and Wetlands of International Importance (Ramsar sites). Biogenetic Reserves, World Heritage Sites and Biosphere Reserves. Areas that meet the published selection criteria for those sites listed above but which are not themselves designated as such.</p> <p>Species: Resident, or regularly occurring, populations of species that are important at an international or European level where the loss of these populations will adversely affect the conservation status or distribution of the species at international geographic scale; or the population forms a critical part of a wider population at this geographic scale.</p>
National (England)	<p>Habitats: Sites including: <ul style="list-style-type: none"> - SSSIs and their associated Impact Risk Zones; - Marine Protected Areas (MPA) including Marine Conservation Zones (MCZ); - National Nature Reserves (NNR); - Areas that meet the published selection criteria e.g. Joint Nature Conservation Committee selection criteria for SSSI (2013) (Ref 9.63) for those sites listed above but which are not themselves designated as such; - Areas of key/priority habitats identified in the UK Biodiversity Action Plan (BAP) (Ref 9.24), including those published in accordance with Section 41 of the NERC Act 2006 (Ref 9.10) and those considered to be of principal importance for the conservation of biodiversity (HPI); and - Areas of Ancient Woodland e.g. woodland listed within the Ancient Woodland Inventory (Ref 9.64). </p> <p>Species: Resident, or regularly occurring populations of species where the loss of these populations will adversely affect the conservation status or distribution of the species at a national scale; or the population forms a critical part of a wider population at a national scale.</p>
Regional (Southern England)	<p>Habitats: Sites including: <ul style="list-style-type: none"> - areas of key and, or priority habitats identified within BAPs produced within the region (where available); and - areas of key and, or priority habitat identified as being of Regional value in the appropriate National Character Area (Ref 9.65) that have been identified by regional plans or strategies as areas for restoration or re-creation of priority habitats. </p> <p>Species: Resident, or regularly occurring populations of species and key and, or priority species listed within the region where: the loss of these populations will adversely affect the conservation status or distribution of the species at regional scale; or the population forms a critical part of a wider population; or the species is at a critical phase of its life cycle at a regional scale.</p>

Importance	Criteria
County (Oxfordshire)	<p>Habitats: Designated sites including:</p> <ul style="list-style-type: none"> - County Wildlife Sites (CWSs). Local Wildlife Sites (LWSs); and Local Nature Reserves (LNRs) designated in the county context; - a statutory designation made under Section 21 of the National Parks and Access to the Countryside Act 1949; - areas which meet the published selection criteria for those sites listed above but which are not themselves designated as such; - areas of key/priority habitats identified in the Local BAP; and - areas of habitat identified in the appropriate National Character Area (or equivalent). <p>Species: Resident or regularly occurring populations of species where the loss of these populations will adversely affect the conservation status or distribution of the species across the county, or the population forms a critical part of a wider population; or the species is at a critical phase of its life cycle.</p>
District (South Oxfordshire/Vale of White Horse)	<p>Habitats Sites including:</p> <ul style="list-style-type: none"> - areas of key/priority habitats identified in the Local BAP; and - areas of habitat identified in the appropriate National Character Area (or equivalent). <p>Species Populations of species of value at a District level (e.g. South Oxfordshire). Resident or regularly occurring populations of species where the loss of these populations will adversely affect the conservation status or distribution of the species at this geographic scale, or the population forms a critical part of a wider population at this scale; or the species is at a critical phase of its life cycle at this scale.</p>
Local (Didcot)	<p>Habitats: Sites including:</p> <ul style="list-style-type: none"> - areas of habitat considered to appreciably enrich the habitat resource within the local context (such as veteran trees), including features of value for migration, dispersal or genetic exchange. This includes trees that are protected by Tree Preservation Orders (TPO's). <p>Species: Populations/ communities of species considered to appreciably enrich the biodiversity resource within the local context.</p>
Negligible (below local)	<p>Habitats: Areas of heavily modified or managed vegetation of low species diversity, or of low value as habitat to species of importance for conservation at county or national scale that do not meet criteria for Local or higher scale.</p> <p>Species: Common or widespread species.</p>

9.4.19 When describing potential impacts and, where relevant, the resultant effects, consideration is given to the following characteristics: positive (beneficial) or negative (adverse) i.e. is the change likely to be in accordance with nature conservation objectives and policy.

- Positive (beneficial) - a change that improves the quality of the environment, or halts or slows an existing decline in quality e.g. increasing the extent of a habitat of conservation importance;
- Negative (adverse) - a change that reduces the quality of the environment e.g. destruction of habitat or increased noise disturbance;

- **Magnitude** - the 'size', 'amount' or 'intensity' of an impact - this is described on a quantitative basis where possible (see Table 9.4);
- **Extent** - the spatial or geographical area or distance over which the impact/ effect occurs;
- **Duration** (e.g. permanent/ temporary) - the time over which an impact is expected to last prior to recovery or replacement of the resource or feature. Consideration has been given to how this duration relates to the relevant biodiversity and geological characteristics, for example a species' lifecycle. However, it is not always appropriate to report the duration of impacts in these terms. The duration of an effect may be longer than the duration of an activity or impact;
- **Reversibility** (e.g. irreversible/ reversible) - i.e. a reversible impact is one from which recovery is possible, or for which effective mitigation is both possible and enforceable. An irreversible effect is one from which recovery is either not possible, or cannot be achieved within a reasonable timescale (in the context of the feature being assessed);
- **Frequency and timing** - i.e. consideration of the point at which the impact occurs in relation to critical life-stages or seasons; and
- **Complexity** (direct, indirect, in-combination or cumulative).

Table 9.4: Level of impact and typical descriptions

Level of impact (change)		Typical description
Major	Adverse	Permanent/ irreversible damage to a biodiversity resource; and the extent magnitude and frequency, and/ or timing of an impact negatively affects the integrity or key characteristics of the resource.
	Beneficial	Permanent addition of, improvement to, or restoration of a biodiversity resource; and the extent magnitude and frequency, and/ or timing of an impact positively affects the integrity or key characteristics of the resource.
Moderate	Adverse	Temporary/reversible damage to a biodiversity resource; and the extent magnitude and frequency, and/or timing of an impact negatively affects the integrity or key characteristics of the resource.
	Beneficial	Temporary addition of, improvement to, or restoration of a biodiversity resource; and the extent magnitude and frequency, and/ or timing of an impact positively affects the integrity or key characteristics of the resource.
Minor	Adverse	Permanent/ irreversible damage to a biodiversity resource; and the extent magnitude and frequency, and/ or timing of an impact does not affect the integrity or key characteristics of the resource.
	Beneficial	Permanent addition of, improvement to, or restoration of a biodiversity resource; and the extent magnitude and frequency, and/ or timing of an impact does not affect the integrity or key characteristics of the resource.
Negligible	N/A	The level of impact is considered sufficiently small as to result in a negligible change to a biodiversity resource and is therefore unlikely to affect the integrity or key characteristics of the resource.
No Change	N/A	The level of impact is considered to result in no change to the biodiversity resource.

9.4.20 In relation to the complexity of an impact:

- A direct impact is considered to be a direct consequence of the Scheme, or a particular activity, including physical loss or gain of a habitat, or direct mortality of individuals or populations.

- An indirect impact is considered to occur via an intermediary or as a result of an impact pathway, for example impacts on air quality or water leading to changes in habitats or the populations of species they support.
 - An in-combination impact occurs where different aspects of the Scheme, act together, to affect habitats and species populations, such as noise disturbance and habitat loss both impacting on a species.
 - A cumulative impact can arise where two or more development projects impact on a biodiversity feature simultaneously or in succession.
- 9.4.21 The impacts on biodiversity arising from the Scheme construction phase and the operation phase are reported separately for each feature e.g. a habitat type or a species or group of species.
- 9.4.22 As the greatest impacts on sites of biodiversity value, habitats and species are generally attributed to those arising from Scheme construction, construction impacts and those associated with the long-term presence of the Scheme are presented together as part of the construction phase impacts within the assessment. The purpose of this is to avoid repetition within the chapter, and to reflect the fact that habitats are lost during site clearance activities and that any new habitats (for example, those proposed as mitigation) will not have been established in the construction period.
- 9.4.23 Impacts arising from the operational phase are those associated with the operation and use of the Scheme e.g. the impacts of vehicle lighting, noise and air pollution arising from traffic travelling on new or improved sections of road within the Scheme, and those associated with any road lighting incorporated into the design of the Scheme.
- 9.4.24 The identification of impacts on biodiversity features during Scheme construction or operation take account of the relevant embedded and standard mitigation measures, and compensation measures, described in the OLBMP (AECOM, 2022) (also refer to Section 9.10).

Identification of likely significant effects

- 9.4.25 The identification of the likely significant effects on biodiversity features has involved combining the importance (value) of a given biodiversity feature with the predicted magnitude of impact, using recognised standards and professional judgement. Magnitude is arrived at by taking the various factors into account i.e. an overall level of magnitude.
- 9.4.26 The process of identification has been guided by the CIEEM guidelines (Ref 9.31), which state that: *“For the purpose of ecological impact assessment, a ‘significant effect’ is an effect that either supports or undermines biodiversity conservation objectives for ‘important biodiversity features’...or for biodiversity in general. Conservation objectives may be specific (e.g. for a designated site) or broad (e.g. national/local nature conservation policy) or more wide-ranging (enhancement of biodiversity)”*.
- 9.4.27 CIEEM (Ref 9.31) advocates that matrices are not used to determine the significance of effects and that each ecological receptor is assessed against its specific conservation objectives. However, to make this chapter comparable with other chapters of this ES, effects have been assessed in relation to the geographic scale at which they may occur (see Section 9.4.17) and the categories of significance applied from those presented in DMRB LA 108 (Ref 9.30). For this assessment, a moderate adverse or beneficial effect or greater is considered to be ‘significant’.

Table 9.5: Significance matrix

Resource importance	Level of impact					
		No change	Negligible	Minor	Moderate	Major
	International or European importance	Neutral	Slight	Moderate or large	Large or very large	Very large
	UK or national importance	Neutral	Slight	Slight or moderate	Moderate or large	Large or very large
	Regional importance	Neutral	Neutral or slight	Slight	Moderate	Moderate or large
	County or District importance	Neutral	Neutral or slight	Neutral or slight	Slight	Slight or moderate
	Local importance	Neutral	Neutral	Neutral or slight	Neutral or slight	Slight
	Negligible importance	Neutral	Neutral	Neutral	Neutral	Neutral

9.5 Assessment assumptions and limitations

- 9.5.1 The information presented in this chapter reflects that obtained and evaluated at the time of reporting and has referenced published data, records and web-based information obtained to date.
- 9.5.2 Habitat and species information referenced in the assessment has been collected from site surveys undertaken on land within and around the Scheme between November 2019 and May 2021, where permission to access the land has been obtained from landowners. Specific assumptions and limitations relevant to each survey, including how any limitations have been overcome and agreed, are included within the technical reports included in Appendices 9.1 to 9.11. None of the survey specific constraints represent a significant limitation or data gap and thus the baseline that has been established is suitably robust. Consequently, the assessment it has informed, presented in this chapter, is robust.
- 9.5.3 Completed surveys have informed the OLBMP. The OLBMP includes targeted landscape and biodiversity mitigation that has been incorporated into the Scheme design. At this stage a preliminary OLBMP has been prepared, however, mitigation is an iterative process and will be updated during the detailed design stage.

Scheme design and limits of deviation

- 9.5.4 The assessment has been based on the Scheme description detailed within ES Chapter 2: The Scheme. Construction works in relation to the Scheme will be contained within the redline boundary of the Scheme. For the purposes of the biodiversity impact assessment, set out in this chapter, it is assumed that most of the Site will be cleared, regardless of the final sizing and layout of the Scheme. The Rochdale Envelope parameters (i.e. the maximum parameters for the Scheme (see Chapter 2: The Scheme, for further information) therefore do not alter the parameters of the assessment of construction (or operation) impacts on biodiversity as they are worst-case.
- 9.5.5 The limits of deviation for the Scheme include defined lateral and vertical limits of deviation for all infrastructure and road elements within the Scheme boundary and

this scenario has been used to identify and report the effects on biodiversity that the limits of deviation could realistically give rise to.

- 9.5.6 The assessment has assumed that all habitats within the limits of deviation surrounding the engineering components of the Scheme will be permanently lost within the footprint of the permanent works.
- 9.5.7 Within the remainder of the land outside of the limits of deviation but within the Site boundary, it has been assumed that there will be a temporary loss of habitat that coincides with areas identified to accommodate construction compounds and/ or biodiversity mitigation. The assessment has assumed that these temporary impacts will not result in the removal of trees, *i.e.* they will be located open areas (arable farmland, hardstanding, etc.), and, except where construction access is required, that boundary features (such as hedgerows) will be retained with a minimum stand-off distance of 5 m and that any habitat lost will be replaced.

9.6 Study Area

- 9.6.1 All designated sites, sensitive habitats and species of importance that occur within the Zone of Influence (Zol) of the Scheme were considered in this assessment. The extent of the Zol varies according to the biodiversity receptor in question and with regard to the precautionary principle; which was used to ensure sufficient data have been gathered to meet any design iterations which may change the likely Zol used to undertake the impact assessment. CIEEM (Ref 9.31) define the Zol as: “...*the area over which biodiversity features may be affected by biophysical changes as a result of the proposed project and associated activities*”.
- 9.6.2 A desk study (see Sections 9.4.4 to 9.4.8 of this chapter) has enabled the determination of appropriate study areas, within which all important biodiversity features requiring assessment, as well as biodiversity features that could be directly or indirectly affected by the Scheme, were subject to field survey. Table 9.2 presents the ecological Zol per species and a description of the Zol of other biodiversity receptors.
- 9.6.3 A number of survey areas were then defined and applied in the assessment, based on the consideration of the likely Zol of the Scheme on a given biodiversity feature.
- 9.6.4 The definition of a survey area was developed using a combination of professional judgement and guidance contained within the CIEEM guidelines (Ref 9.31).
- 9.6.5 In defining survey areas, consideration was given to the geographic location, nature and scale of the Scheme (see ES Chapter 2: The Scheme).
- 9.6.6 Field surveys were then undertaken to characterise the biodiversity baseline within the relevant survey areas as presented in Table 9.2.
- 9.6.7 The Zol distances vary according to the spatial characteristics of each species or habitat potentially impacted but reflects standard professional good practice and the distances that statutory consultees will typically expect to be considered for identification of features external to the Scheme that could be affected. This is informed by published guidance and professional judgement. Further justification on these extents is included in the technical appendices (Appendices 9.1 to 9.11) and was presented to consultees in the EIA Scoping Report and agreed in stakeholder meetings and workshops.

9.7 Baseline conditions

9.7.1 This section describes the baseline environmental characteristics for the Scheme and surrounding areas with specific reference to ecological features.

Existing baseline

Sites statutorily designated for their biodiversity value

9.7.2 The Scheme is not located within, or part of any site statutorily designated for its biodiversity value. However, the desk study (see Section 9.4.5) identified two statutory sites of international importance within 10 km of the Scheme and one site of national importance within 2 km of the Scheme. These sites, designated for biodiversity reasons, are detailed in Table 9.6. The locations of those statutory sites relevant to the Scheme are shown in Figure 9.1 and presented in Appendix 9.1. Statutory sites detailed in Table 9.6 are listed in descending order, with those closest to the Scheme listed first. Site designation details are summarised in Table 9.6 and are taken from citation documents, published online by the JNCC for the individual sites.

9.7.3 There are no international statutory site designations for bats within 30 km of the Scheme.

Table 9.6: Statutory designated sites within 10 km (International sites) and 2 km (National sites) of the Scheme

Statutory Site Name	Reason(s) for Designation	Approximate distance (km) and direction to closest point of Scheme; and relationship to the Scheme	Importance
Culham Brake SSSI	This small area (1.5 ha) of willow carr by the Thames contains one of the largest British populations of a Red Data Book species, Summer Snowflake <i>Leucojum aestivum</i> .	1.2 km north-west of Didcot to Culham River Crossing. Culham Brake SSSI is situated by the River Thames, upstream from the Scheme boundary.	National - SSSI
Little Wittenham SAC (and SSSI)	This site supports one of the largest known breeding populations of Great Crested Newt <i>Triturus cristatus</i> in the UK. The site also supports an outstanding breeding assemblage of other amphibians (which includes Smooth Newt <i>Lissotriton vulgaris</i> , Common Frog <i>Rana temporaria</i> and Common Toad <i>Bufo bufo</i>) and of dragonflies and damselflies.	3.1 km south-east of Clifton Hampden Bypass. River of Life wetland habitat enhancements are being carried out by the Earth Trust on wetland close to the Little Wittenham SAC and SSSI. These wetlands are directly connected to the River Thames and located downstream from the Scheme.	International – SAC
Cothill Fen SAC (and SSSI)	This lowland valley mire contains one of the largest surviving examples of alkaline fen vegetation in central England, a region where fen vegetation is rare.	6.7 km north-west of Didcot to Culham River Crossing. There are no ecological connections between the SAC/ SSSI and the Scheme.	International - SAC

Non-statutory designated sites

9.7.4 The Scheme is not within or part of any site non-statutorily designated for its biodiversity value. However, the desk study (see Section 9.4.5) identified ten sites non-statutorily designated for their biodiversity value within 2 km of the Scheme and these are presented in Table 9.7. These sites have been designated for their biodiversity value at a county level and are known to have supporting value for a wide variety of protected and ecologically important species and, or habitats. The locations of these non-statutory sites, relevant to the Scheme are shown in Figure 9.2 and presented in Appendix 9.1. Non-statutory sites detailed in Table 9.7 are listed in descending order, with those closest to the Scheme listed first.

Table 9.7: Non-statutory Designated Sites within 2 km of the Scheme

Non-statutory Site Name	Reason(s) for Designation	Approximate distance (km) and direction to closest point of Scheme; and relationship to the Scheme	Importance
Furze Brake LWS	Furze Brake is set on a gentle south-facing slope to the southwest of Abingdon. The southern part lies on Lower Greensand, the northern part lies on Gault clay, and a small area to the southwest is on gravel of the third river terrace. This site houses the most important heronry in the upper Thames basin, with nearly 50 active nests. The woodland is predominantly Oak <i>Quercus</i> sp. and Ash <i>Fraxinus excelsior</i> and there are a range of other species present, with plentiful Birch <i>Betula</i> , Wild Cherry <i>Prunus avium</i> , Rowan <i>Sorbus aucuparia</i> and Hornbeam <i>Carpinus betulus</i> . The understorey is quite rich with Spindle <i>Euonymus europaeus</i> and Buckthorn <i>Rhamnus</i> sp., while the ground flora includes abundant Bluebells <i>Hyacinthoides non-scripta</i> with Dog's mercury <i>Mercurialis perennis</i> and Moschatel <i>Adoxa moschatellina</i> . Yellow-star-of-Bethlehem <i>Gagea lutea</i> , which is rare in southern England, has been recorded in the past.	0.2 km north-east of Clifton Hampden Bypass. There are ecological connections between the LWS and the Site area.	County
Thames Clifton to Shillingford Conservation Target Area (CTA)	Area includes remnants of lowland meadow, wet meadow, small areas of wet woodland, woodland, some limestone grassland and patches of fen habitat. Also includes four gravel pits with eutrophic standing water that is important for wintering wildfowl and breeding Great Crested Newts.	0.4 km south of Clifton Hampden Bypass. The CTA includes wetland directly connected to the River Thames and is downstream from the Scheme.	County
Clifton Hampden Wood LWS	This site is part of a narrow strip of woodland on the northern bank of the River Thames between Clifton Hampden and Burcot. The woodland is mainly wet Ash woodland on the level area near the river, with Beech <i>Fagus sylvatica</i> , Sycamore <i>Acer pseudoplatanus</i> Scots Pine <i>Pinus sylvestris</i> , Pedunculate Oak <i>Quercus robur</i> , Field Maple <i>Acer campestre</i> and Horse Chestnut <i>Aesculus hippocastanum</i> on the steeper bank. Crack	0.4 km east of Clifton Hampden Bypass. The LWS is downstream of the Scheme and includes wet woodland directly	County

Non-statutory Site Name	Reason(s) for Designation	Approximate distance (km) and direction to closest point of Scheme; and relationship to the Scheme	Importance
	Willow <i>Salix fragilis</i> and Alder <i>Alnus glutinosa</i> are found beside the river. An important feature of the woodland is the population of the nationally rare Loddon lily (or summer snowflake) <i>Leucojum aestivum</i> comprising perhaps 2,000 - 3,000 mature plants near the river. The Loddon lily population appears healthy with many seedlings. Wet woodland is a priority habitat for conservation in the UK.	connected to the River Thames.	
Clifton Hampden Meadows LWS	This site consists of two meadows adjacent to the Thames. The western meadow previously formed the Local Wildlife Site, which was called Clifton Hampden Meadow. In 2010 the eastern meadow, which was previously referred to as Little Wittenham Nature Reserve Meadow, was added to the site. The west meadow consists of a mosaic of dry rough grassland, swamp and wet grassland areas. Areas of the grassland remain lowland meadow where a number of species typical of this habitat can be seen such as Marsh Marigold <i>Caltha palustris</i> , Sneezewort <i>Achillea ptarmica</i> , Common Knapweed <i>Centaurea nigra</i> , Ragged Robin <i>Lychnis flos-cuculi</i> and Brown Sedge <i>Carex disticha</i> . There are 15 plant species typical of lowland meadow and 16 species typical of fen habitats.	0.4 km east of Clifton Hampden Bypass. The LWS includes wetland directly connected to the Thames and is downstream from the Scheme.	County
Kelart's Field potential LWS (pLWS)	A reasonably diverse large semi-improved grassland area with some elements of lowland meadow habitat. Dominant grasses consist of Red Fescue <i>Festuca rubra</i> , Yorkshire Fog, Creeping Bent <i>Agrostis stolonifera</i> , False Oat-grass <i>Arrhenatherum elatius</i> , Perennial Rye-grass <i>Lolium perenne</i> , Meadow Foxtail, Sweet Vernal-grass and Crested dogs-tail.	0.7 km west of Didcot to Culham River Crossing. There are no ecological connections between the pLWS and the Scheme.	County
Radley Gravel Pits LWS	There are a variety of terrestrial habitats with large areas of open ground, grassland, scrub, sedge bed and reedbed, and small areas of fen and wet woodland. The open ground includes freely drained and waterlogged areas, with a wide variety of ruderals species both native and introduced. The grassland is recent and lies over former arable or gravel areas. It has species which prefer neutral to calcareous and un-grazed conditions. The scrub is mostly over landfill and is composed of Hawthorn <i>Crataegus monogyna</i> and Bramble <i>Rubus fruticosus</i> with introduced species such as Buddleia <i>Buddleja davidii</i> . The sedge beds are species rich and include many young willow (species of <i>Salix</i>).	1.2 km north of Didcot to Culham River Crossing. There are no ecological connections between the LWS and the Scheme.	County

Non-statutory Site Name	Reason(s) for Designation	Approximate distance (km) and direction to closest point of Scheme; and relationship to the Scheme	Importance
Thames Radley to Abingdon CTA	This area includes gravel pits with one site rich in aquatic plants. There are also small areas of wet woodland, areas of fen which is important for Loddon Lily and nesting Lapwing <i>Vanellus vanellus</i> habitat.	1.2 km north of Didcot to Culham River Crossing. There are no ecological connections between the CTA and the Scheme.	County
Radley Gravel Pits Extension South LWS	Forms part of Radley Gravel Pits LWS.	1.3 km north of Didcot to Culham River Crossing. There are no ecological connections between the LWS and the Scheme.	County
Hayward's Eyot LWS	This is a low-lying site adjacent to the River Thames in the village of Long Wittenham. Formerly an island, it comprises channels either side of the site, with springs and ponds to the south. A now extinct major channel of the river to the south created the steep bank which now delimits the site on this side. Summer snowflake is found in a number of locations across the site. This is a Red Data Book species with a very restricted distribution in the UK; this site may carry between five and ten thousand plants, which makes it one of the larger populations. It is also unusual on this site in growing in the open amongst reed and reed sweet grass rather than under willow carr.	1.4 km south-east of Clifton Hampden Bypass. This LWS is adjacent to the River Thames but is downstream from the Scheme.	County
Nuneham Arboretum LWS	This site lies on a plateau and a gently north-east-facing slope on gravel terrace deposits. The soils are neutral to acidic. The site was previously a park and contains areas of unimproved grassland, ponds, woodland and parkland. The woodland is mostly planted with conifers and non-native trees but does include areas with abundant bluebells. The grassland is species-rich in parts with Bird's-foot Trefoil <i>Lotus corniculatus</i> and Cat's-ear <i>Hypochaeris radicata</i> , and Tormentil <i>Potentilla erecta</i> in the acidic areas. The northern meadow is locally dominated by bent (<i>Agrostis</i>) species and Yorkshire Fog <i>Holcus lanatus</i> with Sweet Vernal-grass <i>Anthoxanthum odoratum</i> , Meadow Foxtail <i>Alopecurus pratensis</i> , Crested Dog's-tail <i>Cynosurus cristatus</i> and Tufted Hair-grass <i>Deschampsia cespitosa</i> .	1.8 km north-east of Clifton Hampden Bypass. There are no ecological connections between the LWS and the Scheme.	County

Species records

- 9.7.5 The data search, obtained in December 2019 from TVERC, returned records of protected and notable species within the 2 km search radius of the Scheme and from the preceding ten years. These protected and notable species, including species of conservation importance, can be reviewed in Appendix 9.1.

Habitats

- 9.7.6 The Scheme boundary covers an area of approximately 155.42 ha and the land use within the Scheme boundary is a mixture of agricultural land, an active power station site, an old power station site (Didcot A Power Station) currently undergoing redevelopment, an industrial estate, a live landfill site and a sand quarry. Several water bodies are also present within the Scheme boundary. **There are five habitats that each exceeds 10% of the total area, making up 70% of the Scheme. They are arable (23.1%), tall ruderal (13.8%), freshwater habitats (11.5%), poor semi-improved grassland (11.4%) and improved grassland (10.4%), none of which is a Habitat of Principal Importance apart from some freshwater habitats (Table 9.8).**
- 9.7.7 The terrestrial and aquatic habitats present within the survey area, as identified during the Phase 1 Habitat survey and aquatic scoping survey in 2020, are summarised in Table 9.8 along with area calculations (taken from digitised maps of the Phase 1 Habitat survey habitats) and their ecological values. The locations of these habitats are shown within the accompanying figures in Appendix 9.1.
- 9.7.8 The assessment of biodiversity importance of habitats is Scheme-wide. Where the biodiversity importance of a receptor is specific to a particular section of the Scheme study area, then this is specified in Table 9.8.

Table 9.8: Broad habitat types within the Scheme

Broad habitat type	Approx. area (ha) / length (m)	% of Site area	Notable Habitat	Biodiversity Importance	Rationale
A1.1.1 Broad-leaved semi-natural woodland	3.9 ha	1.7	LBAP habitat. Lowland Mixed Deciduous Woodland is a UK habitat of Principal Importance.	Local	Isolated pockets of semi-natural woodland. The largest single area of this habitat is approximately 1.5 ha adjacent to RWE land within the Science Bridge section, with other smaller areas widely distributed across the Site. None of these are more than local importance due to small and disparate extent, poor species diversity and limited ground flora of value. Similar habitat is abundant more widely beyond the Zol in the local area. Furthermore, this habitat type does not reach the required levels to fulfil the criteria of a priority habitat, nor will it, nor any single pocket of woodland qualify as a LWS under the LWS selection criteria.

Broad habitat type	Approx. area (ha) / length (m)	% of Site area	Notable Habitat	Biodiversity Importance	Rationale
					Therefore, this habitat is of no more than local importance.
A1.1.2 Broad-leaved plantation woodland	9.1 ha	4.0	No	Local	Not a habitat of principal importance.
A2.1 Dense scrub	8.4 ha	3.7	No	Local	Not a habitat of principal importance.
A2.2 Scattered scrub	6.6 ha	2.9	No	Local	Not a habitat of principal importance.
A3.1 Broad-leaved scattered trees	1.4 ha	0.6%	No	Local	Not a habitat of principal importance.
B2.2 Neutral grassland -semi-improved	6.4 ha	2.8	No	Local	Not a habitat of principal importance.
B4 Improved grassland	23.7 ha	10.4	No	Local	Not a habitat of principal importance.
B5 Marsh / marshy grassland	<0.1 ha	<0.1	No	Local	Not a habitat of principal importance.
B6 Poor semi-improved grassland	25.5 ha	11.4	No	Local	Not a habitat of principal importance.
C3.1 Tall ruderal	31.5 ha	13.8	No	Local	Not a habitat of principal importance.
F1 Swamp	1.2 ha	0.5	Reedbed is an LBAP habitat and UK habitat of Principal Importance.	Local	Whilst the overall amount of this habitat is 1.2 ha, the majority occurs within the Hanson Restoration Area as part of the future baseline. No individual reedbed in isolation is of substantial size, as this habitat is located along the fringes of most water bodies and is relatively common and therefore is not considered of importance in the ZoI as this habitat is common in the wider area.
Freshwater: Ponds and Eutrophic Standing Waters)	26.7 ha	11.5	Eutrophic Standing Waters and Ponds are LBAP habitats and may qualify as UK habitat of Principal Importance.	Up to District	The Culham finger lakes (WB16) qualify as eutrophic standing water (lake) UK Habitat of Principal Importance due to the presence of wetland habitats and Charophyte plant species, a species of <i>Nitella</i> . The unnamed lake at the Appleford Siding (WB07)

Broad habitat type	Approx. area (ha) / length (m)	% of Site area	Notable Habitat	Biodiversity Importance	Rationale
					<p>supports European Eel and European Bullhead <i>Cottus gobio</i>, as well as uncommon aquatic macrophyte and macroinvertebrate species.</p> <p>Both water bodies are therefore of District biodiversity importance.</p> <p>Most other standing water bodies within the study area either have little to no aquatic vegetation or have limited ecological value. Therefore, they are of no more than local importance, including the RWE western lagoon.</p>
Freshwater: Rivers with running water (watercourses including ditches with running water)	1.2 ha	0.5	Rivers are an LBAP habitat and may qualify as a UK habitat of Principal Importance.	Up to District	<p>The River Thames (European Eel and brown/sea trout) and Moor Ditch (Bullhead) support notable fish species and these species are likely to utilise other watercourses and water bodies locally – European Eel and Bullhead were also identified in WB07 (see above). The River Thames and Moor Ditch are assessed as of District biodiversity importance due to the presence of notable fish species, and other watercourses within the study area are of local importance. None of the watercourses within the study area qualify as a UK habitat of Principal Importance due to a lack of qualifying features.</p>
I2.2 Artificial spoil	10.0 ha	4.4	No	Negligible	Not a habitat of principal importance.
J1.1 Arable land (including arable margins)	52.5 ha	23.1	Arable margins are an LBAP habitat.	Local	None of the arable field margins support protected or notable plant species and none of the criteria for LWS selection (Ref 9.66) is met.
J1.2 Amenity grassland	0.3 ha	0.1	No	Local	Not a habitat of principal importance.
J1.3 Ephemeral / short perennial	5.0 ha	2.2	No	Local	Not a habitat of principal importance.

Broad habitat type	Approx. area (ha) / length (m)	% of Site area	Notable Habitat	Biodiversity Importance	Rationale
J3.6 Building	0.1 ha	<0.1	No	Negligible	Not a habitat of principal importance.
J4 Bare ground	0.7 ha	0.3	No	Negligible	Not a habitat of principal importance, nor qualifies as 'open mosaic habitat'.
Z99 Hard surface	13.9 ha	6.1	No	Negligible	Not a habitat of principal importance.
Intact hedge (with trees) – native species-rich	300 m	-	LBAP habitat and UK habitat of Principal Importance.	County	Habitat of principal importance. One species-rich and 'important' hedgerow within Scheme.
Intact hedge – species-poor	8,630 m	-	LBAP habitat and UK habitat of Principal Importance.	Local	Habitat of principal importance but does not meet guidance in LWS Selection Criteria (Ref 9.66).
Defunct hedge – species-poor	727 m	-	LBAP habitat and UK habitat of Principal Importance.	Local	Habitat of principal importance but does not meet guidance in LWS Selection Criteria (Ref 9.66).
J2.3.3 Hedge with trees – species-poor	211 m	-	LBAP habitat and UK habitat of Principal Importance.	Local	Habitat of principal importance but does not meet guidance in LWS Selection Criteria (Ref 9.66).
J2.4 Fence	3,527 m	-	No	Negligible	Not a habitat of principal importance.
J2.6 Dry ditch	673 m	-	No	Local	Not a habitat of principal importance.
Standing water (ditches)	666 m	-	No	Local	Not a habitat of principal importance.
A2.2 Scattered scrub (linear)	108 m	-	No	Local	Not a habitat of principal importance

Protected and notable species

- 9.7.9 A summary of protected or notable species that have been identified during the ecological surveys as present, or potentially present within the Scheme boundary and survey areas and an evaluation including importance, value (sensitivity) and rationale of the ecological features for each species is presented in Table 9.9. Full descriptions of the baseline conditions are given in other appendices and accompanying figures, as indicated in Table 9.9.
- 9.7.10 The assessment of biodiversity importance of species is scheme-wide. Where the biodiversity importance of a receptor is specific to a section of the Scheme study area, then this is specified in Table 9.9.

Table 9.9: Summary of baseline details for legally protected and notable species alongside assessment of biodiversity importance of ecological features

Biodiversity Feature (and relevant technical appendix)	Baseline Detail	Nature Conservation Receptor	Assessment of Biodiversity Importance	Rationale
Arable Flora (Appendix 9.2)	No important arable plant scoring species were recorded within any of the fields and therefore there were no important arable plant assemblages within the Site.	None	Local	No legally protected species were recorded within the Site. No rare or threatened arable flora recorded on Site.
Terrestrial Flora (Appendix 9.1 and 9.3)	Two notable species were recorded on Site. Annual Beard Grass (<i>Polypogon monspeliensis</i>) which is nationally scarce and rare in Oxfordshire. The other notable species recorded was Round-fruited Rush (<i>Juncus compressus</i>), which is uncommon and Near Threatened in Great Britain and Vulnerable in England (Ref 9.67) and (Ref 9.68).	Annual Beard Grass and Round-fruited Rush	Local	Annual Beard Grass is introduced in Oxfordshire (Ref 9.69). Neither species is an LBAP species or UK Priority Species, nor legally protected.
Aquatic Macrophytes (Appendix 9.4)	Hairlike Pondweed <i>Potamogeton trichoides</i> and the charophyte alga (a species of <i>Nitella</i> . recorded in the Culham finger lakes south of the River Thames crossing (WB16). Fourteen uncommon species present in the wetland (WB16) as mentioned above, the Harwell ditch/Meadow brook (WB32) and unnamed lake and ponds near the Appleford Railway Sidings (WB07, WB18 and WB19) – refer to Appendix 9.3 for water body reference numbers.	Hairlike Pondweed and <i>Nitella</i> sp. Other notable aquatic macrophyte species and assemblage.	Local	Hairlike Pondweed is listed as Nationally Scarce (occurring in 16-100 hectads in Great Britain) and <i>Nitella</i> , a species of stonewort, is named under UKBAP Eutrophic Standing Waters Priority Habitat but considered of local biodiversity importance. Uncommon species with Local status (recorded from between 101 and 700 grid squares in Britain), however they are not LBAP or UK Priority Species.

Biodiversity Feature (and relevant technical appendix)	Baseline Detail	Nature Conservation Receptor	Assessment of Biodiversity Importance	Rationale
Aquatic Invertebrates (Appendix 9.4)	<p>Emperor Dragonfly <i>Anax imperator</i> recorded in Culham finger lakes (WB16) and unnamed lake at the Appleford Siding (WB07). Species from the family Aeshnidae recorded in unnamed lake and ponds near the Appleford Railway Sidings (WB07, WB19 and WB32). One Stratiomyidae species recorded in unnamed pond south of Appleford (WB18). Species from the family Coenagrionidae recorded in WB07, River Thames (WB15), WB16, WB18, WB19 and WB32.</p> <p>One nationally scarce beetle species recorded in WB19.</p> <p>Desk-study records of Depressed River Mussel <i>Pseudanodonta complanata</i> in the River Thames, 0.52 km south of Clifton Hampden Bypass in 2011.</p> <p>One notable (but not Red Data Book) beetle species recorded in WB07 and WB16. Notable (but not Red Data Book) Trumpet Ramshorn Snail <i>Menetus dilatatus</i> recorded in WB15.</p>	Notable aquatic invertebrate species and assemblages.	Local	<p>Little Wittenham SAC and SSSI is designated in part for the wide diversity of dragonflies and damselflies, including breeding populations of the Brown Hawker <i>Aeshna grandis</i>, Migrant Hawker <i>Aeshna mixta</i> and Emperor Dragonfly. Clubbed General soldier-fly <i>Stratiomys chamaeleon</i> is noted under the Cothill Fen SAC and SSSI, which is uncommon and listed in the Red Data Book of Invertebrates (Ref 9.70). Species such as <i>Coenagrion pulchellum</i> are regarded as nationally rare or notable and are listed in the citation of the Cothill Fen SAC and SSSI because of their scarcity.</p> <p>Depressed River Mussel is a NERC Act (2006) species of principal importance, a UK BAP priority species, and listed globally as Vulnerable on the International Union for Conservation of Nature (IUCN) Global Red List (Ref 9.71), however the species was not recorded in surveys and is therefore assessed as of local biodiversity importance.</p> <p>Beetle species <i>Berosus affinis</i> and Trumpet Ramshorn Snail are notable (but not Red Data Book) under the Community Conservation Index (Ref 9.72).</p>
Terrestrial Invertebrates (Appendix 9.3)	<p>A total of 306 invertebrate species were recorded within the Survey Area, the majority of which are common and widespread.</p> <p>Some notable species present, particularly in habitats identified</p>	Notable terrestrial invertebrate species and assemblages.	<p>Didcot to Culham River Crossing – District.</p> <p>Other Scheme areas - Local</p>	Isolated pockets of habitat across the Scheme for notable invertebrate species.

Biodiversity Feature (and relevant technical appendix)	Baseline Detail	Nature Conservation Receptor	Assessment of Biodiversity Importance	Rationale
	within the Didcot to Culham River Crossing section of the Scheme.			
Fish (Appendix 9.1 and 9.4)	<p>European Eel was recorded in the desk study in the River Thames, and in the unnamed lake at the Appleford Siding (WB07) through eDNA survey.</p> <p>European Bullhead was recorded from eDNA surveys in WB07 and in the desk study in Moor Ditch/Lady Grove Ditch 0.3 km from the Scheme.</p> <p>One record of Brown/Sea Trout <i>Salmo trutta</i> was identified in the River Thames in the desk study from July 2014.</p>	European Eel European Bullhead Brown/Sea Trout	European Eel – County Bullhead and Brown/Sea Trout – Local	<p>European Eel is listed as a species of principal importance under Section 41 of the NERC Act, as a UKBAP 2010 species and a LBAP priority species. It is also critically endangered under the IUCN Red List of Threatened Species.</p> <p>European Bullhead is an Annex II species under the Habitats Directive, which means they are a species of Community interest (i.e. endangered, vulnerable, rare or endemic in the European Community) whose conservation requires the designation of special areas of conservation. Bullhead is also a UK BAP priority species.</p> <p>Brown/ Sea Trout are listed as a SPI.</p>
Great Crested Newt (Appendix 9.6)	<p>826 records of Great Crested Newt (GCN) were returned by the data search, including a record from within the Scheme. Of the 826 records, 731 were associated with the Sutton Courtenay Environmental Education Centre (Berks Bucks & Oxon Wildlife Trust Site (BBOWT Site)) which is located approximately 400 m north of the A4130. Records of Common Toad were also returned from the data search, within the 2 km Study Area.</p> <p>The suitability of all water bodies for GCN was assessed by collecting specified data which were used to calculate a Habitat</p>	Great Crested Newt presence outside of the Scheme, approximately 400 m from the Scheme.	None – Not present within the Scheme or Zol.	<p>Great Crested Newt is listed on Schedule 5 of the Wildlife & Countryside Act 1981 (as amended) (Ref 9.6) which affords them protection under Section 9, as amended by the Countryside Rights of Way Act (2000) (Ref 9.7). They are also protected under Regulation 41 of the Conservation of Habitats and Species Regulations 2017 (Ref 9.2). They are listed on Annex II and VI of the EC Habitats Directive (Ref 9.3), are included as a SPI in England.</p> <p>Positive sighting of five individuals, approximately 400 m from the A4130 Widening section of the Scheme. These waterbodies are to the north of the A4130 Widening and west of the Science bridge sections of the Scheme, with significant barriers, such as main roads and extensive areas of disturbed and bare ground, between the waterbodies and the Scheme.</p>

Biodiversity Feature (and relevant technical appendix)	Baseline Detail	Nature Conservation Receptor	Assessment of Biodiversity Importance	Rationale
	<p>Suitability Index (HSI) for each water body. Water samples taken from those water bodies which had been assessed as being suitable for GCN within 500 m of the Scheme were surveyed to determine the presence or absence of GCN in these water bodies and, or, analysed for environmental DNA (eDNA).</p> <p>No GCN were recorded within the Survey Area during the Great Crested Newt survey using traditional methods and analyses of all water samples for eDNA returned negative results.</p> <p>Five GCN were recorded within the Sutton Courtenay Environmental Education Centre (BBOWT Site).</p> <p>The waterbody within the Scheme that had a record of GCN returned from the TVERC data search (in 2015) was surveyed using eDNA analysis, which found this water body to be negative for the presence of GCN.</p>			<p>No positive eDNA or detection of presence during field surveys so unlikely to be present elsewhere or within the Zol.</p>

Biodiversity Feature (and relevant technical appendix)	Baseline Detail	Nature Conservation Receptor	Assessment of Biodiversity Importance	Rationale
Reptiles (Appendix 9.5)	<p>The data search returned 21 records of Common Lizard <i>Zootoca vivipara</i>, two records of Slow Worm <i>Anguis fragilis</i> and 20 records of Grass Snake <i>Natrix helvetica</i> within the Study Area and within the last ten years of the request date. The closest Common Lizard record from the search was approximately 110 m east of the Scheme in 2016. Both Slow Worm records were returned from outside of the Site, within Sutton Courtenay Environmental Education Centre in 2014 and 2015, approximately 400 m north of the Scheme.</p> <p>Low population (less than 5 individuals) of two species of reptile, Common Lizard and Grass Snake, were recorded within two areas of suitable habitat within the Scheme during field surveys.</p>	<p>Common Lizard and Grass Snake present within Scheme.</p> <p>Slow-worm presence outside of the Scheme, approximately 400 m from the Scheme.</p>	Local	<p>Protected from injury or killing within the Wildlife & Countryside Act 1981 (as amended) (Ref 9.6).</p> <p>Species of principal importance within Section 41 of the NERC Act (Ref 9.10).</p> <p>Low population of two species confirmed within Scheme (see Appendix 9.5).</p>
Breeding birds (Appendix 9.7)	<p>87 bird species were recorded within the Survey Area during surveys for breeding birds, with territories for 53 species confirmed and 14 probable or possible territories, resulting in a breeding bird assemblage of 67 species across the Survey Area.</p>	<p>An assemblage of notable birds breeding within the Scheme.</p>	County	<p>The survey area supports a number of notable species during the breeding season, including Lapwing <i>Vanellus vanellus</i>, Yellowhammer <i>Emberiza citrinella</i>, Linnet <i>Linaria cannabina</i>, Reed Bunting <i>Emberiza schoeniclus</i> and Skylark <i>Alauda arvensis</i>; all are BoCC Red or Amber list species (Ref 9.26), listed as Priority bird species on the UKBAP or species of principal importance (Ref 9.10).</p>

Biodiversity Feature (and relevant technical appendix)	Baseline Detail	Nature Conservation Receptor	Assessment of Biodiversity Importance	Rationale
	Territories of one Annex 1 species (Red Kite) and two WCA Schedule 1 species (Little Ringed Plover <i>Charadrius dubius</i> and Barn Owl <i>Tyto alba</i>) confirmed within the Survey Area. Peregrine <i>Falco peregrinus</i> was nesting outside the Survey Area, Kingfisher <i>Alcedo atthis</i> was probably breeding along the River Thames (based on the number of registrations of this species but was not confirmed as nesting) and Common Tern <i>Sterna hirundo</i> probably nesting within the water bodies south of the River Thames (outside of the Survey Area).	Common nesting bird species throughout the Scheme.	Local	All nesting birds are protected under the Wildlife and Countryside Act 1981 (as amended) (Ref 9.6). Habitat present across the Scheme supports nesting birds.
		Little Ringed Plover – two to three territories; Barn Owl – one territory, Red Kite – three territories, Kingfisher – possible territory, Common Tern – one to two probable territories.	Little Ringed Plover in the Didcot to Culham River Crossing – District Barn Owl – Local Red Kite – Local Kingfisher – Local Common Tern in the Didcot to Culham River Crossing - District	Specially protected species owing to inclusion on Annex 1 of the EU Birds Directive (Ref 9.4) and, or, Schedule 1 species on the Wildlife and Countryside Act (1981), as amended (Ref 9.6). Whilst specially protected, populations of Barn Owl, Red Kite and Kingfisher are not considered of importance at a national or county level. However, consideration will be given to their legal status further on in this chapter.
		Shoveler <i>Spatula clypeata</i> Gadwall <i>Mareca strepera</i> Oystercatcher <i>Haematopus ostralegus</i> Ringed Plover <i>Charadrius hiaticula</i>	Shoveler, Gadwall and Oystercatcher in the Didcot to Culham River Crossing – District Ringed Plover in the Didcot to Culham River Crossing – County	BoCC Amber species (Ref 9.26), rare breeding species in Oxfordshire (professional judgement, based on Birds of Oxfordshire, 2018 (Ref 9.73).
Non-breeding (wintering) birds (Appendix 9.8)	With reference to Appendix 9.8, 79 bird species were recorded during the wintering bird surveys. The peak count of Red Kite (51 individuals) was recorded	Assemblage of notable wintering birds	County	None of the wintering bird populations constitutes 1% of the relevant county population, including Red Kite, which is not considered further as a non-breeding species.

Biodiversity Feature (and relevant technical appendix)	Baseline Detail	Nature Conservation Receptor	Assessment of Biodiversity Importance	Rationale
	predominantly passing over the survey area and the Scheme is not considered to represent an important resource for the species.	Lapwing	Didcot to Culham River Crossing - County	Peak counts likely to represent a population approaching (or greater than) 1% of the county population and are therefore of county importance.
Bats (Appendix 9.9)	Three species of bat, (Common Pipistrelle <i>Pipistrellus pipistrellus</i> , Soprano Pipistrelle <i>Pipistrellus pygmaeus</i> and Brown Long-eared bat <i>Plecotus auritus</i>), were confirmed to be roosting within trees and buildings. Species recorded on the activity surveys (crossing point surveys, activity transects and static bat detectors) in 2020 comprised at least eight species: Common Pipistrelle, Soprano Pipistrelle, Nathusius' Pipistrelle <i>Pipistrellus nathusii</i> , Noctule <i>Nyctalus noctula</i> , Leisler's bat <i>Nyctalus leisleri</i> , Serotine <i>Eptesicus serotinus</i> Brown Long-eared bat, Barbastelle <i>Barbastella barbastellus</i> and unknown <i>Myotis</i> species.	Foraging and commuting activity throughout of common and rarer bat species and roosts within and adjacent to the Site.	Roosting bats - Local Foraging/ commuting bats: Common Pipistrelle – County Soprano Pipistrelle – County Nathusius' Pipistrelle, Noctule, Leisler's bat, Serotine and Brown Long-eared bat - Local Barbastelle - County <i>Myotis</i> species – County	Confirmed roosts in eight buildings and three trees, consisting of day, night and feeding roosts used by small (1-7 individuals) numbers of common and widespread species of bat, using evaluation criteria of Wray <i>et al.</i> (2010) (Ref 9.74) and CIEEM (Ref 9.31).
Badger	Badger setts in active use (as of April 2021) were identified within the Scheme. Owing to the confidential nature of this information, the locations of Badger setts are not included within this chapter.	At least five separate Badger social groups present within or in the vicinity of the Scheme.	Local	Badgers are legally protected under The Protection of Badgers Act 1992 (Ref 9.12) and the Scheme has embedded mitigation to prevent breaches of this legislation.

Biodiversity Feature (and relevant technical appendix)	Baseline Detail	Nature Conservation Receptor	Assessment of Biodiversity Importance	Rationale
Hazel Dormouse (Appendix 9.10)	The data search returned no records of Dormouse. Surveys of hedgerows across the Scheme did not record presence or evidence of Dormouse.	Dormouse is not present within the Scheme or Zol.	None – not present within the Scheme or Zol.	Dormouse is protected under Schedule 5 of the Wildlife & Countryside Act 1981 (as amended) (Ref 9.6) and under The Conservation of Habitats and Species Regulations 2017 (as amended) (Ref 9.2).
Water Vole (Appendix 9.11)	The data search returned 45 records of Water Vole within 2 km of the Site, the closest of which was within a ditch 300 m north-east of the southern section of the Didcot to Culham River Crossing section of the Scheme. No Water Vole recorded was recorded within the Survey Area during surveys.	Change or loss of peripheral habitat used by Water Vole. Precautionary principle of presumed presence of Water Vole in watercourses and water bodies outside of the Survey Area.	Local	Water Vole is protected under Schedule 5 of the Wildlife & Countryside Act 1981 (as amended) (Ref 9.6). No Water Vole recorded, but in consideration of this species' potential presence in the wider area and declining status in a national and county context, the population of Water Vole is potentially of local importance.
Otter (Appendix 9.11)	The presence of Otter was recorded in two watercourses, namely the River Thames and Moor Ditch, which are crossed by the Scheme. No active Otter holts recorded within the Scheme boundary, but potential holts and resting sites were recorded in the Otter survey area on the River Thames and Moor Ditch.	Change or loss of peripheral habitat used by Otter.	Local	Otter is protected under Schedule 5 of the Wildlife & Countryside Act 1981 (as amended) (Ref 9.6) and under The Conservation of Habitats and Species Regulations 2017 (as amended) (Ref 9.2). Otter has an estimated British population of 11,000 and the population size and range are increasing. A low population size recorded on the Site but no active holts or natal dens. The Scheme has embedded mitigation to prevent breaches of the legislation.
Invasive non-native species (Appendix 9.1 and 9.5)	Curly Waterweed <i>Lagarosiphon major</i> was recorded in the fishing pond near the Appleford rail sidings (WB32). Himalayan Balsam <i>Impatiens glandulifera</i> was recorded on the	Potential impacts upon native species and habitats within and outside the Scheme boundary due to the spread of invasive non-	N/A	Schedule 9 species under the Wildlife and Countryside Act (WCA) 1981 (Ref 9.6), except Zebra Mussel which is a highly invasive non-native species but not listed under Schedule 9 of WCA 1981 (Ref 9.6).

Biodiversity Feature (and relevant technical appendix)	Baseline Detail	Nature Conservation Receptor	Assessment of Biodiversity Importance	Rationale
	<p>banks at of Moor ditch (WB09 and WB11) and The River Thames (WB15).</p> <p>New Zealand Pigmyweed <i>Crassula helmsii</i> was recorded at the unnamed lake near Appleford Sidings (WB07) and Culham finger lakes (WB16) and 0.46 km north of the Scheme in the desk-study.</p> <p>Nuttall's Waterweed <i>Elodea nuttallii</i> was recorded at WB07, WB15 and WB16 and in Ladygrove Ditch (Moor Ditch) in the desk study.</p> <p>Desk study identified:</p> <p>Signal Crayfish <i>Pacifastacus leniusculus</i> 0.3 km east of the Scheme;</p> <p>Chinese Mitten Crab <i>Eriocheir sinensis</i> 0.5 km west of the Scheme; and</p> <p>Zebra Mussel <i>Dreissena polymorpha</i> records 0.76 km west of the Scheme.</p>	<p>native species, and associated biosecurity risks, e.g. due to the spread of water-borne diseases such as crayfish plague.</p>		

- 9.7.11 Hazel Dormouse was confirmed to be absent within the Scheme and was therefore scoped out of the assessment and is not considered further.

Future baseline

- 9.7.12 Professional judgement has been used to predict the natural and human influences that are likely to change the baseline conditions as set out in the previous section, prior to the Scheme construction period (2023). The habitat within the Scheme boundary and up to 50 m from the Scheme, is largely arable farmland, cropped on rotation, bordered by hedgerows, scrub, woodland and connecting ditches. In the short to medium term, in absence of the Scheme and other development, these habitats would continue to provide for ground-nesting breeding birds. In the long term, in the absence of the Scheme, habitats on-site will be under agricultural management and therefore the distribution of some species will change in response to cropping, whilst the assemblages may remain the same. Much of the currently undeveloped land surrounding the Scheme is allocated for housing and commercial development. Even in the absence of the Scheme, it is reasonable to assume that due to these allocations the quality and extent of habitats surrounding the Scheme will diminish and species distributions will contract, as the landscape is altered.
- 9.7.13 The future baseline has been assumed to include the Hanson restoration area, including the Culham finger lakes (WB16), according to the Hanson Aggregates Sutton Courtenay - Bridge Farm Revised Restoration Scheme. While the restoration scheme may not be fully implemented or matured by 2023, the proposed habitats are assumed to form part of the construction year baseline for the Scheme. The areas of restored habitat to be affected by the Scheme form a wetland vegetation mosaic, including:
- Reedbed and wet woodland planting subsequent to re-grading – areas of reedbed and reed fringe to be crossed by embankment and viaduct, with areas lost for embankment and viaduct piers, and other areas affected by shading;
 - Wet woodland will occupy slightly higher ground out on the fingers, and at the higher western ends of the fingers that remain above winter flood levels – areas of existing tree and scrub vegetation will be lost for embankment and viaduct piers, and other areas affected by shading;
 - Dry lake margins intended to be managed as wet flower-rich grassland approximating to MG4/MG5 grassland, interspersed with tree clumps along shorelines – areas of such grassland will be lost for embankment and viaduct piers, and other areas affected by shading; and
 - Areas of standing water to be lost by embankment and viaduct placement, and areas to be shaded by the viaduct.
- 9.7.14 It is acknowledged that climate change can lead to changes in the distribution and abundance of some biodiversity features at the local level; however, any such changes are likely to occur over a relatively long period of time. It is unlikely that there will be any significant changes to biodiversity features by 2023 as a result of climate change.
- 9.7.15 Should there be any large-scale changes in agricultural policies and practices by 2023, these may result in changes to the land use within and surrounding the Scheme boundary, which could possibly result in some changes in the extent of the agricultural land. Notwithstanding this, any such changes are unlikely to alter the importance of the biodiversity features recorded between 2019 and 2021, given that planning policy will likely continue to minimise the loss of biodiversity features and seek BNG.

- 9.7.16 ES Chapter 17: Assessment of Cumulative Effects presents details of future planned developments that may influence baseline conditions prior to the construction of the Scheme. The cumulative effects of these developments have been taken account of as part of the cumulative assessment.
- 9.7.17 Based on available information, there are no reasons to expect that there will be any marked change in the habitats associated with the Scheme by the year 2024. Habitats such as broad-leaved trees and scrub will be more mature but are likely to support a broadly similar species assemblage, whilst arable farmland will also be managed accordingly, maintaining broadly similar species assemblages.

9.8 Summary of important ecological features

- 9.8.1 Table 9.10 summarises the important ecological features that are relevant to the Scheme including where they are located along the Scheme. Based on CIEEM guidelines and using professional judgement, features of local importance i.e. less than district importance, are not considered further in the assessment process, unless legislation requires their consideration.
- 9.8.2 The following species were surveyed for within the Scheme and Zol, but found not to be present or present outside of the Scheme's Zol:
- Great Crested Newt;
 - Water Vole; and
 - Hazel Dormouse.
- 9.8.3 Badger and Otter are present within the Scheme and Zol, but their populations and usage of the Scheme are not of a level of importance sufficient to take forward for assessment. However, in recognition of their protected status, the Scheme has embedded appropriate mitigation to minimise impacts in line with the relevant legislation. These measures are set out in Section 9.10.

Table 9.10: Summary of important ecological features

Important Ecological Feature	Scheme Area	Reason for Valuation	Level of Biodiversity Importance
Culham Brake SSSI	Whole Scheme	Statutory site of nature conservation importance	National
Little Wittenham SAC and SSSI	Whole Scheme	Statutory site of nature conservation importance	International
Cothill Fen SAC and SSSI	Whole Scheme	Statutory site of nature conservation importance	International
Ten sites of county importance (LWS, CTA or pLWS)	Whole Scheme	Non-statutory sites of nature conservation importance	County
Standing water – Culham finger lakes (WB16) and unnamed lake at the Appleford Siding (WB07)	Didcot to Culham River Crossing	Culham finger lakes is a Habitat of Principal Importance – Eutrophic Standing Water; WB07 supports European Eel and Bullhead	District
Running Water (River Thames and Moor Ditch)	Didcot to Culham River Crossing and Science Bridge	Presence of notable fish assemblage	District
Hedgerows	Clifton Hampden Bypass	A single species-rich hedgerow, based on guidance in LWS selection criteria (Ref 9.66) is likely to be of County Importance	County
Terrestrial Invertebrates	Didcot to Culham River Crossing	Notable terrestrial invertebrate species and assemblages	District
Fish – European Eel and Bullhead	Didcot to Culham River Crossing	European Eel, a SPI, in WB07; Bullhead and Brown/ Sea Trout also present	Up to County
Breeding Birds	Whole Scheme	An assemblage of notable birds breeding within the Survey Area	County
	Didcot to Culham River Crossing	Population of specially protected species: Little Ringed Plover and Common Tern	District
	Didcot to Culham River Crossing	Population of Shoveler, Gadwall, Oystercatcher and Ringed Plover	Up to County
Non-breeding (wintering) birds	Whole Scheme	Population of wintering birds -species diversity	County
	Didcot to Culham River Crossing	Population of Lapwing	County
Bats – Common Pipistrelle, Soprano Pipistrelle, Barbastelle and species of <i>Myotis</i> .	Whole Scheme	Foraging/ commuting activity	County

9.9 Potential impacts

- 9.9.1 The construction and operation of the Scheme could potentially result in the following impacts and effects.

Construction

- 9.9.2 Impacts on biodiversity features during construction of the Scheme are likely to include:

- Habitat loss or gain – direct impacts associated with changes in land use resulting from the Scheme, for example temporary works associated with site clearance, and permanent land-take associated with the installation of drainage infrastructure and earthworks, including viaduct piers;
- Fragmentation of populations or habitats – indirect impacts due to the Scheme dividing a habitat, group of related habitats, site or ecological network, or the creation of partial or complete barriers to the movement of species, with a consequent impairment of ecological function;
- Disturbance – indirect impacts resulting from a change in normal conditions (light, noise, vibration, human activity) that result in individuals or populations of species changing behaviour or range;
- Habitat degradation – direct or indirect impacts resulting in the reduction in the condition of a habitat and its suitability for some or all of the species it supports, for example changes in chemical water quality or changes in surface flow or groundwater, or shading; and
- Species mortality – direct impacts on species populations associated with mortalities due to construction activities, for example site clearance.

Operation

- 9.9.3 Impacts on biodiversity features during the operational phase of the Scheme are likely to include:

- Species mortality – direct impacts on species populations associated with mortalities from collisions with vehicles and potentially from pollution incidents or management practices;
- Habitat degradation – indirect impacts associated with the operation of new road lighting and vehicles using new and/ or improved sections of road, for example increased light, noise, shading and changes in air quality leading to a reduction of habitat quality on identified biodiversity features; and
- Disturbance – indirect impacts arising from changes in human activity, including use of public rights of way that could lead to changes in animal behaviour, for example changes in roosting behaviour or nesting success.

9.10 Design, mitigation and enhancement measures

- 9.10.1 The Scheme has been designed, as far as possible, to avoid and minimise impacts and effects on important ecological features through the process of design-development (see ES Chapter 3: Assessment of Alternatives).
- 9.10.2 Several standard mitigation measures have also been identified that will be implemented by the principal contractor (PC), to reduce the impacts and effects that construction of the Scheme will have on biodiversity features. An OEMP (AECOM,

2021) has been prepared for the Scheme to manage any environmental effects of the Scheme and to demonstrate compliance with environmental legislation. The PC will prepare a CEMP which will be based on, and incorporate, the content and requirements of the OEMP as necessary.

Embedded design measures

Habitat avoidance, creation and replacement

- 9.10.3 The Scheme has been designed so that impacts upon important habitats are avoided or reduced, where reasonably practicable. This has included designing the Scheme to avoid key habitats, such as water bodies.
- 9.10.4 The environmental masterplans and preliminary landscape planting measures developed as part of the landscape and visual assessment reported in ES Chapter 8: Landscape and Visual Effects have been informed by the outcomes of engagement and the biodiversity assessment. The key objective is to identify measures that, wherever possible, provide a combined function of landscape integration and/ or screening, and habitat creation and replacement, to mitigate scheme effects on biodiversity interests.
- 9.10.5 Habitat planting and reinstatement will replace habitat temporarily damaged, or permanently lost (see Table 9.8) as a result of the Scheme to achieve an overall BNG with a particular emphasis on priority habitats. **The area of habitats lost and created as part of the Scheme are presented in the BNG Assessment report.**
- 9.10.6 Habitat creation will include hedgerows, grassland planting, reedbed, wet woodland, wet flower-rich grassland, approximating to MG4/MG5 grassland; and standing water.
- 9.10.7 The Scheme drainage strategy has been developed to manage surface water runoff in accordance with current highway design standards and will reduce the likelihood and severity of potential pollution incidents and flooding affecting watercourses and the local ditch network to reduce or eliminate adverse effects for aquatic and riparian species and habitats. Drainage will be treated by attenuation features such as ponds and existing ditches, and watercourses and other attenuation features will be landscaped to provide optimal water treatment.
- 9.10.8 Lighting for the Scheme will include footway and cycleway lighting utilising 5 m lighting columns. Where lighting is essential, it will conform to best practice guidelines with respect to minimising light spill into adjacent habitats and prevent disturbance to bats and other species. The River Thames crossing, part of the Didcot to Culham River crossing section, and Appleford Sidings Road Bridge will not be lit.

Protected and notable species

- 9.10.9 The following measures have been incorporated into the design of the Scheme to mitigate impacts and effects on protected and, or notable species. Some of these have a direct relationship with the essential mitigation measures for protected species as detailed later in this section, that will be implemented prior to, or during construction. These measures will be included in the OLBMP and the contractor's CEMP.

Reptiles and invertebrates

- 9.10.10 The Scheme design includes the creation of habitats which will be of value to terrestrial invertebrates and reptiles, such as grassland and scrub. Furthermore, with the provision of log and brash piles, placed in both sunny and shady locations, this

variety of habitats will benefit both terrestrial invertebrates and reptiles. Once the vegetation along the Scheme verges has established, these will also provide a wildlife corridor which reptiles can utilise for basking, foraging and shelter.

Birds

- 9.10.11 Some areas of breeding and wintering bird habitat, including hedgerows, scrub, grassland and arable land, will be lost to the Scheme. This loss will be mitigated through habitat creation and replacement measures incorporated throughout the Scheme, which comprise hedgerows, scrub and grassland habitat that have been incorporated into the landscape design of the Scheme. There will be a net loss of arable habitat which will be replaced elsewhere within the Scheme by grassland, woodland and scrub. This will achieve a better balance of habitats within the landscape in order to secure a net gain in biodiversity for birds.
- 9.10.12 Any loss of trees and scrub used by nesting birds will be mitigated by replacement planting of hedgerows and woodland, together with the installation of approximately 100 bird boxes.

Bats

- 9.10.13 Habitat creation and replacement will provide more foraging habitat within the landscape, and the planting of trees and hedgerows will provide connectivity for bats to commute between foraging grounds. Attenuation ponds will be built as part of the Scheme and these will also provide foraging opportunities for some species of bat.
- 9.10.14 To ensure that the Scheme has a positive contribution towards local bat populations, a minimum of 50 bat boxes to provide roosting opportunities, will be installed within suitable habitats (such as mature trees) adjacent to the Scheme.
- 9.10.15 A permanent 'hop-over' which is a crossing of a road or highway for bats will be implemented to maintain important commuting and foraging routes for bats where the Scheme is likely to cause severance. The purpose of the hop-over is to guide bats across the road at a safe height above traffic, thus reducing the risk of mortality by guiding bats over the road. This mitigation is required to maintain connectivity to the north of Clifton Hampden and along the River Thames, although there will also be sufficient clearance under the new bridge to facilitate safe passage of low flying species. The hop over will be formed through permanent mature tree planting, designed into the soft landscaping, the height of which will be above the Scheme to encourage bats to fly up and over the Scheme. In addition to this, scrub will be planted alongside the Scheme to discourage bats from crossing the road low down.
- 9.10.16 The design has sought to minimise potential lighting impacts with directed luminaires to reduce spill. The lighting will comprise LED luminaires that will be less attractive to flying insects, so that bats are not attracted to forage on insects that can be attracted to traditional lighting, particularly ultraviolet spectrums.
- 9.10.17 The impact of any noise on foraging and commuting bats will be reduced, through landscaping and planting, which will act as a natural acoustic barrier.

Badger

- 9.10.18 Badgers will be deterred from crossing the Scheme through the installation of Badger fencing in selected areas along the highway, the locations of which will be informed by up to date information on Badger activity. Currently, this is within the Clifton Hampden Bypass, Didcot Science Bridge and Didcot to Culham River Crossing sections of the Scheme, in the vicinity of Badger setts that were recorded. Where

evidence of Badgers crossing any existing infrastructure, or potentially important connecting habitat in the open countryside (used by Badger) has been identified, Badger tunnels will be constructed to allow them safe passage under the carriageway. Whilst it is not possible to guarantee complete exclusion of Badger, the combination of fencing, tunnels and suitable landscaping should discourage their use of highway verges and minimise contact with live traffic. The specific location and layout of fencing will be determined following pre-commencement surveys, to ensure that the current usage of the site by Badger informs appropriate mitigation. All proposed mitigation measures will be agreed in advance with the LPA. Fencing and tunnel specifications will follow best practice guidance set out in DMRB HA 59/92 - Mitigating Against Effects on Badgers (amendment No. 2) and evidence available from other highways schemes.

Riparian mammals and aquatic habitats

- 9.10.19 Culverts will be designed appropriately to maintain connectivity along watercourses for aquatic species and riparian mammals, based on the results of the ecological surveys and the suitability of watercourses to support particular species. The Moor Ditch culvert for example will include a mammal ledge of 500 mm width to facilitate passage of riparian mammals such as Otter. All culverts to convey watercourses will be set 150 mm below bed level to allow sedimentation and a riverbed to form, which will maintain longitudinal connectivity for fish and other aquatic fauna.

Essential mitigation measures

- 9.10.20 The contractor's CEMP (based upon the OEMP) will detail and formalise the measures that will be implemented during construction of the Scheme to comply with environmental legislation and mitigate construction-related effects on biodiversity associated with the transfer of invasive non-native species, dust deposition, air pollution, pollution incidents, water quality, light, noise and vibration.
- 9.10.21 Mitigation during construction will include fencing in accordance with British Standards Institution (BSI) 5837:201230 (Ref 9.75) to protect trees and their root zones and other existing vegetation that does not require removal.
- 9.10.22 During construction, measures to mitigate the impact of dust on ecological receptors will be implemented. Cutting, grinding or sawing equipment will be fitted with, or be used in conjunction with, suitable dust suppression techniques such as water sprays or local extraction (for example suitable local exhaust ventilation systems). Materials that have the potential to produce dust will be removed from the Site as soon as possible unless they are being re-used. Full details of these measures can be found in ES Chapter 6: Air Quality and ES Chapter 10: Noise and Vibration.
- 9.10.23 To minimise adverse impacts on watercourses and associated species, measures will be taken to prevent or minimise any sediments entering the freshwater, using control measures as outlined in CIRIA C532 Control of Water Pollution from Construction Sites (Ref 9.76). Further details can be found in ES Chapter 14: Road Drainage and the Water Environment.
- 9.10.24 Piling will be required close to water bodies for the construction of viaduct piers for the Didcot to Culham River Crossing. This will affect the River Thames and the Culham finger lakes. To avoid potential impacts to fish and other aquatic and riparian fauna, the following mitigation will be implemented during piling:
- ensuring a soft start to piling to allow fauna to escape the immediate works area;

- use of low vibration equipment and methods (including no start-up or shut down of large vibratory rollers within 50 m of receptors (15 m for medium sized twin drum rollers) rather than percussive piling close to the river; and
- avoidance of key fish spawning periods for piling adjacent to the River Thames (i.e. the closest piers within approximately 7 m). Brown trout are unlikely to spawn in this location in the River Thames, however the main spawning period of January to June should be avoided.

Protected species

- 9.10.25 Pre-construction surveys will be undertaken to validate and, where necessary, update the baseline survey findings. The purpose of these pre-construction surveys is to ensure mitigation during the construction phase is based on the latest protected species information. This will also be required for any protected species licensing.
- 9.10.26 Mitigation strategies will be prepared for protected species and, where required, application for species licences from Natural England for relocation of animals away from construction areas sufficiently in advance of the works to meet with the optimum time for mitigation and to minimise any changes to the construction programme.
- 9.10.27 Vegetation clearance and earthworks will be supervised by a suitably experienced ecologist acting as an Ecological Clerk of Works (ECoW) in areas confirmed to have protected species present or habitat considered to have high potential for protected species. Toolbox talks will be prepared and delivered onsite to all personnel prior to any works overseen by the ECoW.
- 9.10.28 Where invasive non-native species were recorded on the Site, pre-construction surveys will be undertaken to update on the presence and location of any invasive species, the findings of which will inform the implementation of measures to prevent their spread into the wild. This will include production of a Biosecurity and Invasive Non-Native Species Management Plan which will set out procedures to ensure that no invasive species are brought onto the Site (e.g. Wildlife & Countryside Act 1981 (as amended) (Ref 9.6) Schedule 9 species). If any future infestations of invasive non-native species are identified prior to and, or during the development process, exclusion zones will be established around them and the ECoW contacted for advice.
- 9.10.29 The following specific measures (where relevant) will be implemented during Scheme construction to protect retained vegetation, protected species and other areas of biodiversity value from disturbance, damage and accidental pollution.

Fish

- 9.10.30 Pre-construction survey for fish will be undertaken in the RWE western lagoon to establish what fish species are present and the requirement for fish rescue and translocation during decommissioning and removal of the lagoon. Fish surveys will take the form of eDNA sampling, given the consideration that fish are unlikely to be present, and if they are will likely constitute three-spined stickleback and other minor species.
- 9.10.31 Direct impacts to the unnamed lake and ponds at the Appleford Siding (WB07, WB18, WB19 and WB32) and the Culham finger lakes (WB16) are proposed. Parts of the water bodies at Appleford Siding will be lost to the Scheme, and embankment and viaduct piers will encroach into WB16. European Eel, Bullhead and nine other species were identified in WB07, and Roach was identified in WB16. Therefore, fish rescue, removal and translocation will be required during construction and prior to any draining of water bodies to ensure fish welfare and compliance with fisheries

legislation. Fish capture will be facilitated by an FR2 application to use fishing instruments other than rod and line from the EA, and fish translocation may require an SP1 Application for a Live Fish Movements Site Permit, also from the EA, and potentially a fish health check. This will be agreed in consultation with the local EA Biodiversity Team.

Reptiles

- 9.10.32 Vegetation removal in areas where reptiles were identified (areas of grassland) will be removed when reptiles are inactive (between November and February), concordant with the requirements for breeding birds. Any hibernacula present will be removed in advance of November, to reduce the potential for reptiles to be present in areas to be cleared of vegetation. Relocation of reptiles will not be necessary.

Breeding birds

- 9.10.33 Vegetation clearance will avoid, where possible, the bird nesting season (typically March to August, inclusive). Where any vegetation clearance is scheduled between March and August, a suitably experienced ecologist will need to undertake a nesting bird check on any vegetation to be cleared (and potentially retained vegetation in the vicinity of the clearance), no more than 24 hours prior to works commencing.
- 9.10.34 Pre-construction surveys (during the appropriate nesting season) will be required by a suitably qualified ecologist, to check for the presence of specially protected bird species (i.e. those listed on Schedule 1 of the Wildlife and Countryside Act 1981, as amended (Ref 9.6)). Specially protected species are at potential risk of disturbance and therefore, these checks will ensure that the proposed mitigation strategy is adequate. Where any 'new' specially protected species are identified, then the potential impacts of construction may need to be reappraised and mitigation revised. This will be informed by the suitably qualified ecologist.

Bats

- 9.10.35 Pre-construction surveys will be undertaken on all trees to be felled with bat roosting potential to update their roost status' and confirm the presence of any new roosts to be lost within the Scheme boundary or outside the Scheme boundary that may be subject to disturbance. The nature of these surveys will depend on the age and nature of data held, the roost suitability of the features and timing of works. A European Protected Species (EPS) mitigation licence application will be submitted to Natural England in advance of works and mitigation will be implemented in accordance with the conditions of the EPS mitigation licence.
- 9.10.36 Typical roost compensation for the loss of roosts of Local importance for the species currently identified (i.e. Common Pipistrelle, Soprano Pipistrelle and Brown Long-eared bat) is normally in the form of boxes within suitable retained and protected habitats and these will be placed accordingly across the Scheme (see also Section 9.10.14).
- 9.10.37 Construction impacts on bats will be minimised (see Section 9.10.16) and include appropriate timing of works under Natural England EPS mitigation licences, where applicable.
- 9.10.38 Any lighting used during construction will be directional, to ensure light spill is minimised into adjacent habitats, and will only be used where necessary (such as for Health & Safety in the winter months when daylight working hours are reduced). Construction lighting design will minimise the impacts on roosting and foraging bats in accordance with ILP/BCT guidance (Ref 9.77).

- 9.10.39 Where sections of hedgerows will be removed to facilitate access during construction, these will be limited to be no more than 10 m wide to avoid severance of commuting routes used by bats. Any temporary removal of hedgerows will be replanted following construction completion.

Badger

- 9.10.40 Due to the presence of Badger setts within the red-line boundary of the Clifton Hampden Bypass and on RWE land near the Didcot Science Bridge, it will be necessary to permanently exclude Badgers under licence from Natural England. Any setts within the Scheme will need to be closed prior to construction, and outside of the Badger breeding season (30 November until 30 June). Two artificial setts are currently required as these main setts will have to be closed and these will be delivered within existing territories of these Badger clans, although locations are not specifically provided in this application due to confidentiality. Mitigation to prevent injury to Badger (and other mammals) during construction works will include the provision of ramps into any open excavations to allow any Badger that have fallen in to escape. Any retained setts within the Scheme will have an appropriate exclusion zone of 30 m around the sett to prevent disturbance and accidental damage.
- 9.10.41 Pre-construction surveys for Badger will be undertaken to determine baseline conditions remain the same as currently recorded and whether there have been any changes to Badger distribution. Where this occurs, Natural England licences and mitigation measures will be updated accordingly.

Riparian mammals

- 9.10.42 Pre-construction surveys for Otter and Water Vole will be undertaken to determine baseline conditions remain the same as currently recorded and whether there have been any changes to the distribution of these species. Where this occurs, Natural England licences (if required) will be applied for and mitigation measures will be updated accordingly, to ensure no disturbance to one or both species occurs and that continued safe passage along the Moor Ditch and River Thames is maintained. Surveys will include the monitoring of all potential resting places, including those identified in baseline surveys, to establish the requirement for any further specific mitigation measures.
- 9.10.43 Mitigation to prevent injury to riparian mammals during construction works will include the provision of ramps into any open excavations to allow any riparian mammals that have fallen in to escape.

Operation

- 9.10.44 A three-year aftercare period will follow, during operation of the Scheme and on completion of the construction works. Maintenance activities will be undertaken during this period to ensure the successful establishment of planting and provision of any new functioning habitats, which will include the replacement of any failed or defective plants. Maintenance and monitoring tasks will be prescribed in the OLBMP to be developed by the principal contractor.
- 9.10.45 In the longer term, between years five and 20, maintenance objectives and activities will be detailed in a Biodiversity Management Plan (BMP). The BMP will include monitoring measures aimed at reviewing the successful establishment of habitats and the use of mitigation measures by fauna, for example, mammal underpasses.
- 9.10.46 Post-construction monitoring will be undertaken at appropriate intervals to ensure successful delivery and long-term management of mitigation and enhancement

measures. The results of which will be used to refine the prescriptions of the BMP over the lifetime of the Scheme.

Enhancement measures

- 9.10.47 Enhancement measures have been incorporated into the design of the Scheme which focus principally on the creation of areas of habitat in excess of those required to mitigate habitat losses due to the Scheme. These include hedgerow, grassland and scrub habitat as well as new areas of woodland.
- 9.10.48 The area of habitats that will be created as part of the Scheme are presented in the BNG Assessment report.
- 9.10.49 The OLBMP (AECOM, 2022) sets out the key measures required to achieve biodiversity net gain through the design and implementation of the Scheme. The OLBMP will also provide management prescriptions aimed at ensuring the Scheme delivers biodiversity benefits over the long term.

9.11 Screening of likely significant effects

9.11.1 This section describes the impacts and potential effects of the Scheme on relevant ecological features inclusive of the mitigation measures as detailed in Section 9.10.

9.11.2 Relevant ecological features are those that are considered important and have the potential to be affected by the Scheme. Potential impacts and effects arising from the construction and operation phases of the Scheme are provided in Table 9.11 to Table 9.12, which are described further in Section 9.12. Sites designated statutorily and non-statutorily for biodiversity value.

Table 9.11: Determination of Relevant Ecological Features – Designated Sites

Ecological Feature	Biodiversity Importance	Potential impacts / effects	Potential for significant effects?
Culham Brake SSSI	National	<p>Construction: This statutory designated site is approximately 1.2 km north-west of the Scheme. The SSSI is designated for its willow carr habitat. There are no ecological connections between Culham Brake SSSI and the Scheme. A small section of the SSSI is adjacent to the River Thames, upstream from the Scheme.</p> <p>The construction of the Scheme will not directly impact on habitat within Culham Brake SSSI.</p> <p>There will be no fragmentation of habitats, or of populations of species, using habitats within Culham Brake SSSI during construction.</p> <p>There will be no disturbance to Culham Brake SSSI or habitat degradation through preparation of the Scheme for construction, although the construction of the Scheme will result in dust generation, along with noise and visual disturbance. Noise and visual disturbance will not impact on the integrity or the functioning this SSSI site, owing to the distance between this SSSI and the Scheme. Additionally, standard environmental protection measures will be implemented and adopted during construction, formalised through a CEMP – such measures include dust suppression and pollution prevention. Consequently, indirect effects to Culham Brake SSSI during construction are not anticipated to occur and there will be no effect to the integrity of this designated site.</p> <p>There will be no species mortality of any species associated with Culham Brake SSSI during construction of the Scheme.</p> <p>In summary, there are no impact pathways, either directly or indirectly, that will impact upon the integrity or functioning of Culham Brake SSSI.</p>	No
		<p>Operation: The distance separating the Scheme from Culham Brake SSSI (greater than 1 km) is sufficient to ensure that there are no impact pathways including from nitrogen emissions from traffic on roads (see ES Chapter 6: Air Quality). There are no other impact pathways (e.g. habitat loss or</p>	No

Ecological Feature	Biodiversity Importance	Potential impacts / effects	Potential for significant effects?
		disturbance to designated site features such as through noise, lighting or visual) during operation of the Scheme which could affect these statutory designated sites.	
Little Wittenham SAC, SSSI	International	<p>Construction: Little Wittenham SAC and SSSI is approximately 3.1 km south-east of the Scheme and is designated for its populations of amphibians, primarily its population of Great Crested Newt. There are no ecological connections between the SAC/ SSSI and the Scheme.</p> <p>The construction of the Scheme will not directly impact on habitat within the SAC and SSSI.</p> <p>There will be no fragmentation of habitats, or of populations of species, using habitats within Little Wittenham SAC/ SSSI during construction.</p> <p>There will be no disturbance to Little Wittenham SAC/ SSSI or habitat degradation through preparation of the Scheme for construction, although the construction of the Scheme will result in dust generation, along with noise and visual disturbance. Noise and visual disturbance will not impact on the integrity or the functioning of this SAC/ SSSI site, owing to the distance between this statutory site and the Scheme. Additionally, standard environmental protection measures will be implemented and adopted during construction, formalised through a CEMP - these measures will include dust suppression and pollution prevention. Consequently, indirect effects to Little Wittenham SAC/ SSSI during construction are not anticipated to occur and there will be no effect to the integrity of this designated site.</p> <p>There will be no species mortality of any species associated with Little Wittenham SAC/ SSSI, during construction of the Scheme.</p> <p>In summary, there are no impact pathways, either directly or indirectly, that will impact upon the integrity or functioning of Little Wittenham SAC/ SSSI.</p>	No
		<p>Operation: The distance separating the Scheme from Little Wittenham SAC, SSSI is greater than 3 km, which is sufficient to ensure that there are no impact pathways including from nitrogen emissions from traffic on roads (see ES Chapter 6: Air Quality). There are no other impact pathways (e.g. habitat loss or disturbance to designated site features such as through noise, lighting or visual) during operation of the Scheme which could affect these statutory designated sites.</p>	No
Cothill Fen SAC, SSSI	International	<p>Construction: Cothill Fen SAC and SSSI is approximately 6.7 km north-west of the Scheme and is designated for its alkaline fen vegetation. There are no ecological connections between the SAC/ SSSI and the Scheme.</p> <p>The construction of the Scheme will not directly impact on habitat within the SAC and SSSI.</p> <p>There will be no fragmentation of habitats, or of populations of species, using habitats within Cothill Fen SAC/ SSSI during construction.</p> <p>There will be no disturbance to Cothill Fen SAC/ SSSI or habitat degradation through preparation of the Scheme for construction, although the construction of the Scheme will result in dust generation,</p>	No

Ecological Feature	Biodiversity Importance	Potential impacts / effects	Potential for significant effects?
		<p>along with noise and visual disturbance. Noise and visual disturbance will not impact on the integrity or the functioning this SAC/ SSSI site, owing to the distance between this statutory site and the Scheme. Additionally, standard environmental protection measures will be implemented and adopted during construction, formalised through a CEMP - these measures will include dust suppression and pollution prevention. Consequently, indirect effects to Cothill Fen SAC/ SSSI during construction are not anticipated to occur and there will be no effect to the integrity of this designated site.</p> <p>There will be no species mortality of any species associated with Cothill Fen SAC/ SSSI, during construction of the Scheme.</p> <p>In summary, there are no impact pathways, either directly or indirectly, that will impact upon the integrity or functioning of Cothill Fen SAC/ SSSI.</p>	
		<p>Operation: The distance separating the Scheme from Cothill Fen SAC/ SSSI is greater than 6 km, which is sufficient to ensure that there are no impact pathways including from nitrogen emissions from traffic on roads (see ES Chapter 6: Air Quality). There are no other impact pathways (e.g. habitat loss or disturbance to designated site features such as through noise, lighting or visual) during operation of the Scheme which could affect these statutory designated sites.</p>	No
Furze Brake LWS; Thames Clifton to Shillingford CTA; Clifton Hampden Wood LWS; Clifton Hampden Meadows LWS; Kelart's Field pLWS	County	<p>Construction: These non-statutory designated sites (primary designation being for habitats (woodland or grassland)) are all within 1 km of the Scheme and there are no ecological connections between these designated sites and the Scheme, with the exception of Furze Brake LWS which is ecologically connected via hedgerows. There are hydrological links between the Scheme and Thames Clifton to Shillingford CTA, Clifton Hampden Wood LWS and Clifton Hampden Meadows LWS. These non-statutory sites are all downstream of the Scheme.</p> <p>The construction of the Scheme will not directly impact on habitat within these designated sites.</p> <p>There will be no fragmentation of habitats, or of populations of species using habitats, within these designated sites during Scheme construction.</p> <p>During construction, there is potential for pollutant spills and surface runoff into the River Thames and other connected watercourses, that have the potential to adversely affect habitats and species. Unmitigated, these indirect effects will potentially adversely affect the integrity of connected habitats and designated sites. The impact, whilst short term during the period of construction, may result in medium term effects to habitats within the watercourses and connected habitats within designated sites. For example, the aquatic environment may take a number of years to recover from the results of a pollution spill during construction. However, standard environmental protection measures will be implemented and adopted during construction, formalised through a CEMP - these measures will include pollution prevention measures. Furthermore, a drainage strategy will be implemented for management of surface water during Scheme operation (via SuDS treatment for attenuation of flows</p>	No

Ecological Feature	Biodiversity Importance	Potential impacts / effects	Potential for significant effects?
		<p>and treatment of water quality prior to discharge of any water into watercourses – refer to ES Chapter 14: Road Drainage and the Water Environment). Consequently, indirect effects (such as disturbance and habitat degradation) to the River Thames (and therefore to connected watercourses and habitats) during construction are not anticipated to occur and there will be no effect to the integrity of these non-statutory designated sites.</p> <p>Preparation of the site and the construction of the Scheme will result in dust generation, along with noise and visual disturbance. Noise and visual disturbance will not impact on the integrity or the functioning of these sites, owing to the distance between these sites and the Scheme.</p> <p>There will be no species mortality of any species associated with these designated sites, during construction of the Scheme.</p>	
		<p>Operation: There is predicted to be no impact pathways from nitrogen emissions from traffic on roads (see ES Chapter 6: Air Quality) on Clifton Hampden Wood LWS; Clifton Hampden Meadows LWS; Kelart's Field pLWS. There are no other impact pathways (e.g. habitat loss or disturbance to designated site features such as through noise, lighting or visual) during operation of the Scheme which could affect these statutory designated sites.</p>	No
Radley Gravel Pits LWS; Thames Radley to Abingdon CTA; Radley Gravel Pits Extension South LWS; Hayward's Eyot LWS; Nuneham Arboretum LWS	County	<p>Construction: These non-statutory designated sites (primary designation being habitats) are all more than 1 km from the Site and there are no ecological or hydrological connections (with the exception of Hayward's Eyot LWS, which is downstream of the Scheme) between these designated sites and the Scheme.</p> <p>The construction of the Scheme will not directly impact on habitat within these designated sites.</p> <p>There will be no fragmentation of habitats, or of populations of species using habitats, within these designated sites during construction.</p> <p>Preparation of the site and the construction of the Scheme will result in dust generation, along with noise and visual disturbance. Noise and visual disturbance will not impact on the integrity or the functioning of these LWS or CTA sites, owing to the distance between these designated sites and the Scheme. During construction, there is potential for pollutant spills and surface runoff into watercourses, that have the potential to adversely affect habitats and species within Hayward's Eyot LWS which is downstream of the Scheme. Unmitigated, these indirect effects will potentially adversely affect the integrity of the LWS. The impact, whilst short term during the period of construction, may result in medium term effects to habitats within the watercourses and connected habitats within designated sites. For example, the aquatic environment may take a number of years to recover from the results of a pollution spill during construction. However, standard environmental protection measures will be implemented and adopted during construction, formalised through a CEMP - these measures will include pollution prevention measures. Furthermore, a drainage strategy will be</p>	No

Ecological Feature	Biodiversity Importance	Potential impacts / effects	Potential for significant effects?
		<p>implemented for management of surface water during operation (via SuDS treatment for attenuation of flows and treatment of water quality prior to discharge of any water into watercourses - refer to ES Chapter 14: Road Drainage and the Water Environment). Consequently, indirect effects (such as disturbance and habitat degradation) to Hayward's Eyot LWS during construction are not anticipated to occur and there will be no effect to the integrity of this non-statutory designated site.</p> <p>There will be no species mortality of any species associated with these designated sites, during construction of the Scheme.</p>	
		<p>Operation: Owing to the distance between the Scheme and these non-statutory designated sites, there are no pathways (e.g. habitat loss or disturbance to designated site features such as through noise, lighting or visual) during operation of the Scheme which could affect these non-statutory designated sites.</p>	No

Habitats

Table 9.12: Determination of Relevant Ecological Features – Habitats

Ecological Feature and Scheme Location	Biodiversity Importance	Potential impacts / effects	Potential for significant effects?
Freshwater: Ponds and Eutrophic Standing Waters) – Culham finger lakes (WB16) and unnamed lake at the Appleford Siding (WB07) – Didcot to Culham River Crossing.	District	<p>Construction: Areas of standing water and reed beds/ reed fringes will be lost in the Culham finger lakes (WB16) due to embankment and viaduct pier placements for the Didcot to Culham River Crossing. Habitat creation and replacement will ensure that at least like-for-like habitat is created in line with the Hanson Restoration Scheme; for example, riparian planting has been incorporated along the Thames riparian zone in the corridor between the river and the Hanson Restoration Area (refer to the OLBMP).</p> <p>Compensatory habitat at the Hanson Restoration Area will be created to replace habitat lost through embankment and viaduct piers. This may include riparian enhancement along the corridor between WB16 and the River Thames, including the planting of marginal trees and vegetation, and the reconfiguration of proposed habitats in the Restoration Area.</p>	Yes
		<p>Operation: The effects of increased shading on the Culham finger lakes are considered negligible due to the alignment of the viaduct (north - south) and the width and height (approximately 4 m above ground level in the centre of each span) of the viaduct in relation to the size of the water body. Nevertheless, areas of reedbed and other habitats in the Hanson Restoration Area may need to be</p>	No

Ecological Feature and Scheme Location	Biodiversity Importance	Potential impacts / effects	Potential for significant effects?
		relocated away from the viaduct, piers and embankment to maintain the equivalent total habitats within the area.	
		Construction: Approximately 19% (0.7ha) of the unnamed lake at the Appleford Siding (WB07), together with parts of ponds WB18, WB19 and WB32, will be lost through the Scheme. WB07 supports European Eel, Bullhead and nine other fish species, and habitat will be lost for these species.	Yes
		Operation: The effects of increased shading on WB07 will be negligible due to the lack of notable macrophyte community in the water body.	No
Freshwater: Rivers with running water (watercourses including 'ditches' with running water) (River Thames and Moor Ditch) Didcot to Culham River Crossing; and Science Bridge.	District	Construction: The River Thames will be crossed by a clear-span (approximately 65 m) viaduct with no direct impacts to the watercourse or its banks. Viaduct piers will be at their closest approximately 7 m from the top of the bank. The width of the viaduct will be approximately 17.9 m and approximately 4.7 m above the river at normal flow levels. This will lead to direct habitat loss.	Yes
		Operation: The effects of shading on the river will be negligible given the width of the viaduct in the context of the river as a whole, the lack of aquatic macrophytes at the crossing location, and the high turbidity of the river itself.	No
		Construction: Moor Ditch will be culverted at the location of an existing culvert – the length of watercourse culverted will be reduced from approximately 74 m to 40 m. The existing culvert will be removed and impacts to the watercourse will be minimised through mitigation described in ES Chapter 14: Road Drainage and the Water Environment. Flow within the watercourse will be maintained during construction by over-pumping or similar means.	Yes
		Operation: The new culvert will include an inverted bed to allow natural substrate to develop, and a mammal ledge to maintain longitudinal connectivity. Therefore, the re-designed culvert will represent an improvement compared to the existing culvert.	No
Hedgerows – species-rich. Clifton Hampden Bypass	County	Construction: Whilst the embedded mitigation measures in Section 9.10 includes the retention and avoidance of most hedgerows, there will be a loss of small sections of recently planted hedgerow during Scheme construction. About a third of a species-rich and 'important' hedgerow (H3) within the Clifton Hampden Bypass will be lost. These habitats will be restored, post-construction, but there is likely to be a temporary (short-term) adverse effect on this habitat type.	Yes
		Operation: There are no pathways (e.g. habitat loss and pollution) during operation of the Scheme which could affect hedgerows.	No

Species

Table 9.13: Determination of Relevant Ecological Features –Species

Ecological Feature and Scheme Location	Biodiversity Importance	Potential impacts / effects	Potential for significant effects?
Terrestrial Invertebrates – Didcot to Culham River Crossing	District	<p>Construction: Construction activities will potentially result in the direct loss of habitats used by notable terrestrial invertebrate species and assemblages, although the majority of these habitats are outside of the Scheme boundary (see Appendix 9.3). Although, land has been embedded within the Scheme for creation of habitats suitable for invertebrate species and assemblages, these will take time to develop and therefore, there is likely to be a temporary (short-term) adverse effect on some species. However, significant areas of habitat will be retained and their quality improved (through positive management and reinforced planting), which will mitigate in the short-term for the loss of other habitats and whilst mitigation areas develop.</p> <p>All retained habitats present within the Site will be protected during construction, with all measures formalised in the CEMP.</p> <p>During construction, there is the potential that preparation of the Site and construction of the Scheme will result in dust and other pollutants (such as emissions from construction vehicles and oil-spills) which may impact habitats supporting terrestrial invertebrates. The implementation of standard environmental protection measures during construction, such as dust suppression and pollution prevention, will be adopted and these measures will be formalised in the CEMP. Consequently, pollution during construction is not anticipated to affect the integrity of retained habitats supporting terrestrial invertebrates.</p>	Yes
		<p>Operation: There are no pathways (e.g. habitat loss and disturbance of habitats) during operation of the Scheme which could affect terrestrial invertebrates. However, there may be impacts as a result of habitat degradation. There is potential for indirect impacts associated with acute pollution incidents such as traffic collisions or from longer term diffuse pollution. Mitigation measures for managing surface water runoff, set out in ES Chapter 14: Road Drainage and the Water Environment, include provision of measures for the treatment of polluted runoff such that no impacts are likely to occur. Degradation of habitats, from lighting, will not occur as measures will be taken to ensure lighting is directional and does not spill over into adjacent areas. Disturbance from vehicles and human activity will not impact upon terrestrial invertebrates.</p>	No
Fish – European Eel and Bullhead – Didcot to Culham River Crossing	Up to County	<p>Construction: The construction of the Scheme will impact on the unnamed lake at the Appleford Siding (WB07), a water body supporting European Eel and Bullhead, and also parts of ponds WB18, WB19 and WB32. Aquatic habitats supporting fish have been retained as much as is practicable and measures embedded within the Scheme design to protect retained habitats during construction. Part of WB07 will be lost during construction and fish rescue and translocation will be required to move fish from the works area. The Culham finger lakes (WB16) will also be affected by construction of the embankment and</p>	Yes

Ecological Feature and Scheme Location	Biodiversity Importance	Potential impacts / effects	Potential for significant effects?
		<p>viaduct piers, and fish rescue and translocation away from the works areas will be required during construction.</p> <p>There will be temporary fragmentation of watercourses including Moor Ditch during construction, and this watercourse has been shown to support Bullhead. The existing Moor Ditch culvert will be replaced with a shorter culvert of a larger size, with inverted base to allow the development of a natural substrate and maintain longitudinal connectivity for fish and other fauna; this will also be the case for other proposed culverts. Mitigation including fish rescue and translocation may be required during construction of culverts to relocate fish away from the works areas.</p> <p>During construction, there is the potential that preparation of the Site and construction of the Scheme will result in dust and other pollutants (such as emissions from construction vehicles and oil-spills) which may impact aquatic habitats supporting fish. The implementation of standard environmental protection measures during construction, such as dust suppression and pollution prevention, will be adopted and formalised in the CEMP. Furthermore, a drainage strategy will be implemented for management of surface water during Scheme operation (via SuDS treatment for attenuation of flows and treatment of water quality prior to discharge of any water into any watercourses - refer to ES Chapter 14: Road Drainage and the Water Environment). Consequently, indirect effects (such as disturbance and habitat degradation) to retained watercourses and water bodies during construction are not anticipated to occur. Consequently, pollution during construction will not affect the integrity of retained aquatic habitats.</p> <p>With embedded and essential mitigation, there will be no species mortality of any species within aquatic habitats during construction of the Scheme.</p>	
		<p>Operation: There will be no direct impacts to the habitats supporting fish during operation of the Scheme and therefore, no species mortality. However, there may be impacts as a result of habitat degradation from potential pollution incidents. There is potential for indirect impacts associated with acute pollution incidents such as traffic collisions or from longer term diffuse pollution. Mitigation measures for managing surface water runoff, set out in ES Chapter 14: Road Drainage and the Water Environment, include the provision of measures for the treatment of polluted runoff to ensure that no impacts are likely to occur. Degradation of habitats, from lighting, will not occur as measures will be taken to ensure lighting is directional and does not spill over into adjacent areas. Disturbance from vehicles and human activity will not impact upon fish populations using aquatic habitats.</p> <p>Shading effects due to watercourse crossings, notably the River Thames crossing, will not have a significant effect on watercourses due to the width of the viaduct in the context of the river as a whole, the lack of aquatic macrophytes at the crossing location, and the high turbidity of the river itself.</p>	No

Ecological Feature and Scheme Location	Biodiversity Importance	Potential impacts / effects	Potential for significant effects?
Breeding birds assemblage – whole Scheme	County	<p>Construction: The construction of the Scheme will lead to the loss of habitat used by breeding bird species, although the amount of permanent habitat loss has been minimised as far as reasonably practicable. There may be temporary displacement of breeding birds during construction.</p> <p>Best practice construction methods, as detailed in the CEMP, will include implementation of measures to minimise noise, lighting and vibration disturbance to breeding birds to ensure that, where construction of the Scheme is undertaken within the bird breeding season (typically March to August inclusive), then disturbance to breeding birds in adjacent and retained habitats will be minimised.</p> <p>The construction of the Scheme, if undertaken within the bird breeding season (typically March to August inclusive) has the potential to cause mortality to breeding birds in habitats that are to be removed. Nesting bird checks will need to be undertaken by an ornithologist prior to construction (where this occurs within the breeding season) to ensure there is no species mortality. Therefore, with mitigation in place, there will be no species mortality of any breeding bird species during construction of the Scheme.</p>	Yes
		<p>Operation: There is a risk of accidental mortality from collision with vehicles, although where this occurs this is unlikely to severely impact upon species populations recorded within the vicinity of the Scheme.</p> <p>Measures to prevent pollution control (see ES Chapter 14: Road Drainage and the Water Environment) and to avoid light spill into areas of adjacent retained habitats will mean that there is no habitat degradation and therefore, no impacts upon breeding birds.</p> <p>Disturbance events from changes in human activity may cause temporary disturbance to breeding birds, although this is unlikely to impact upon breeding bird behaviour to such an extent that it causes failures in nesting attempts, mortality to species and, or, impacts upon species populations.</p>	No
Population of breeding Little Ringed Plover and Common Tern – Didcot to Culham River Crossing	District	<p>Construction: The construction of the Scheme will result in small loss of wetland habitat, used by Little Ringed Plover and Common Tern, although the amount of habitat lost to these species, in the context of the surrounding habitat and retained wetland habitats, will be minimised as far as is reasonably practicable.</p> <p>Best practice construction methods as detailed in the CEMP will include implementation of measures to minimise noise, lighting and vibration disturbance to breeding birds such that, where construction of the Scheme is undertaken within the bird breeding season (typically March to August inclusive), then disturbance to breeding birds in adjacent and retained habitats will be minimised. However, if construction is undertaken within the bird breeding season (March to August inclusive) there is the potential for disturbance to affect breeding Little Ringed Plover (a species included on Schedule 1 of the Wildlife and Countryside Act, 1981 (as amended)).</p> <p>The construction of the Scheme, if undertaken within the bird breeding season (typically March to August inclusive) has the potential to cause mortality to breeding birds in habitats that are to be removed. Nesting</p>	Yes

Ecological Feature and Scheme Location	Biodiversity Importance	Potential impacts / effects	Potential for significant effects?
		bird checks will need to be undertaken by an ornithologist prior to construction (where this occurs within the breeding season) to ensure there is no species mortality. Therefore, with mitigation in place, there will be no species mortality of any breeding bird species associated during construction of the Scheme.	
		<p>Operation: There is a risk of accidental mortality from collision with vehicles, although where this occurs this is unlikely to severely impact upon species populations recorded within the vicinity of the Scheme. Measures to prevent pollution control (see ES Chapter 14: Road Drainage and the Water Environment) and to avoid light spill into areas of adjacent retained habitats will mean that there is no habitat degradation and therefore, no impacts upon breeding birds.</p> <p>Disturbance events from changes in human activity may cause temporary disturbance to breeding birds, although this is unlikely to impact upon breeding bird behaviour to such an extent that it causes failures in nesting attempts, mortality to species and, or, impacts upon species populations.</p>	No
Population of breeding Shoveler, Gadwall, Oystercatcher and Ringed Plover – Didcot to Culham River Crossing	Up to County	<p>Construction: The construction of the Scheme will result in small loss of wetland habitat used by Shoveler, Gadwall, Oystercatcher and Ringed Plover, although the amount of habitat lost to these species, in the context of the surrounding habitat and retained wetland habitats, will be minimised as far as is reasonably practicable.</p> <p>Best practice construction methods as detailed in the CEMP will include implementation of measures to minimise noise, lighting and vibration disturbance to breeding birds such that, where construction of the Scheme is undertaken within the bird breeding season (typically March to August inclusive), then disturbance to breeding birds in adjacent and retained habitats will be minimised.</p> <p>The construction of the Scheme, if undertaken within the bird breeding season (typically March to August inclusive), has the potential to cause mortality to breeding birds in habitats that are to be removed. Nesting bird checks will need to be undertaken by an ornithologist prior to construction (where this occurs within the breeding season) to ensure there is no species mortality. Therefore, with mitigation in place there will be no species mortality of any breeding bird species associated during construction of the Scheme.</p>	No
		<p>Operation: There is a risk of accidental mortality from collision with vehicles, although where this occurs this is unlikely to severely impact upon species populations recorded within the vicinity of the Scheme. Measures to prevent pollution control (see ES Chapter 14: Road Drainage and the Water Environment) and to avoid light spill into areas of adjacent retained habitats will mean that there is no habitat degradation and therefore, no impacts upon breeding birds.</p> <p>Disturbance events from changes in human activity may cause temporary disturbance to breeding birds, although this is unlikely to impact upon breeding bird behaviour to such an extent that it causes failures in nesting attempts, mortality to species and, or, impacts upon species populations.</p>	No

Ecological Feature and Scheme Location	Biodiversity Importance	Potential impacts / effects	Potential for significant effects?
Non-breeding (wintering) birds – whole Scheme	County	<p>Construction: The construction of the Scheme will lead to the loss of habitat used by non-breeding bird species, although the amount of permanent habitat loss has been minimised as far as reasonably practicable with hedgerows and woodland areas retained, meaning the majority of wintering bird species will not be affected. There may be temporary displacement of non-breeding birds using wetland habitats in the Didcot to Culham River Crossing section, during construction.</p> <p>Best practice construction methods as detailed in the CEMP will include implementation of measures to minimise noise, lighting and vibration disturbance to non-breeding birds such that disturbance to non-breeding birds in adjacent and retained habitats is minimised. However, there may be disturbance to birds using wetland habitats in the Didcot to Culham River Crossing.</p> <p>There will be no species mortality of any non-breeding bird species associated during construction of the Scheme.</p>	Yes
		<p>Operation: There is a risk of accidental mortality from collision with vehicles, although where this occurs this is unlikely to severely impact upon species populations recorded within the vicinity of the Scheme.</p> <p>Best practice construction methods as detailed in the CEMP will include implementation of measures to minimise noise, lighting and vibration disturbance to wintering birds.</p> <p>Disturbance events from changes in human activity may cause temporary disturbance to non-breeding birds, although this is unlikely to impact upon bird behaviour to such an extent that it causes mortality to species and, or, impacts upon species populations.</p>	No
Non-breeding (wintering) birds: Lapwing – Didcot to Culham River Crossing	County	<p>Construction: The construction of the Scheme will result in small loss of wetland habitat, used by Lapwing, although the amount of habitat lost, in the context of the surrounding habitat and retained wetland habitats, will be minimised as far as is reasonably practicable. Whilst Lapwing is also a species that utilises arable farmland, which is abundant in the local area, the loss of wetland habitat will displace this species into the surrounding area. However, where this occurs, this is unlikely to lead to a significant effect on Lapwing.</p> <p>Best practice construction methods as detailed in the CEMP will include implementation of measures to minimise noise, lighting and vibration disturbance to breeding birds such that, where construction of the Scheme is undertaken within the bird breeding season (typically March to August inclusive), then disturbance to breeding birds in adjacent and retained habitats will be minimised.</p> <p>There will be no species mortality of any non-breeding Lapwing, associated during construction of the Scheme.</p>	No
		<p>Operation: There is a risk of accidental mortality from collision with vehicles, although where this occurs this is unlikely to severely impact upon species populations recorded within the vicinity of the Scheme.</p>	No

Ecological Feature and Scheme Location	Biodiversity Importance	Potential impacts / effects	Potential for significant effects?
		<p>Best practice construction methods as detailed in the CEMP will include implementation of measures to minimise noise, lighting and vibration disturbance to wintering birds.</p> <p>Disturbance events from changes in human activity may cause temporary disturbance to non-breeding birds, although this is unlikely to impact upon bird behaviour to such an extent that it causes mortality to species and, or, impacts upon Lapwing populations.</p>	
Bats – Common Pipistrelle, Soprano Pipistrelle, Barbastelle and species of <i>Myotis</i> . – whole Scheme	County	<p>Construction: Potential impacts associated with construction are based on the construction phase lasting approximately 18 to 20 months between 2023 and 2024. Potential impacts relate to all sections of the Scheme, with the Didcot to Culham River Crossing and Clifton Hampden bypass sections being of higher significance based on the baseline bat data, habitats present and offline sections of the Scheme in these locations.</p> <p>The potential impacts relating to bat species comprise:</p> <ul style="list-style-type: none"> Habitat loss (or gain): These are short to medium term direct impacts related to the change in land use resulting from the Scheme. This will include vegetation clearance, change in use such as the creation of drainage ponds, habitat creation and enhancements opportunities; Fragmentation of populations or habitats: Indirect impacts due to breaking up of a habitat, ecosystem, or land-use type into smaller parcels, or the creation of partial or complete barriers to the movement of species, with a consequent impairment of ecological function (due to building the Scheme and its permanent presence). Several hedgerows and wetlands are bisected by the Scheme, particularly in the Didcot to Culham River Crossing and Clifton Hampden Bypass sections. Additional planting and crossing point features are included to prevent fragmentation; Disturbance to species: An indirect impact resulting from a change in normal conditions (such as light, noise) that will result in bats changing their typical behaviour; and Species mortality: A direct impact on a population of a bat species associated with mortalities due to construction activities. Disturbance and mortality will aim to be avoided by retaining and avoiding roosts and habitats used by bats and precautionary methods of working detailed in the CEMP. Where impacts to roosts (i.e. loss or significant disturbance) are predicted, then appropriate mitigation will be put in place through an EPS mitigation licence. 	Yes
		<p>Operation: Operational phase potential impacts are associated with traffic use of the Scheme, plus its on-going long-term maintenance. The potential impacts of the Scheme during the operational phase relating to important biodiversity features are:</p>	Yes

Ecological Feature and Scheme Location	Biodiversity Importance	Potential impacts / effects	Potential for significant effects?
		<ul style="list-style-type: none"> Species mortality: A direct impact on bat species associated with mortalities from collisions with vehicles, possible pollution incidents and management practices. Additional planting and crossing point features are included to prevent mortality; and Disturbance to species: An indirect impact resulting from a change in normal conditions (such as light and noise from traffic) that will result in the bats changing their typical behaviour (such as changes in roosting behaviour). The OEMP includes recommendations for appropriate lighting provision on an appropriate lighting plan and landscaping. <p>During both construction and operational phases there may be the potential for habitat degradation through run-off, changes in air quality etc. Standard pollution prevention controls will be in place to avoid degradation of habitats and thus significant effects will be avoided – such effects are thus not assessed.</p>	
Invasive Non-Native Species (INNS)	N/A	<p>Construction: There is the potential for INNS to be spread within and outside the Scheme boundary during construction, for example by construction activities and earthworks, movement of plant machinery, works within watercourses or water bodies, stockpiling or transfer of spoil materials, the transfer of construction waste off-site, and transfer of INNS on Personal Protective Equipment (PPE), site clothing and other materials and equipment.</p> <p>The CEMP will detail best practice biosecurity measures to be implemented during construction to prevent the spread of INNS, which will constitute an offence under the Wildlife and Countryside Act (WCA) 1981 (as amended) for those species listed under Schedule 9 of the Act. The Scheme has the potential to generate a beneficial effect where invasive plant species are locally eradicated, for example within construction compound areas or permanent land take.</p>	No
		<p>Operation: There is the potential for INNS to be spread during operation of the road network through vehicle movement and air turbulence. This is likely to be comparable to the natural dispersal and spread of the species shown to be present, for example by dispersal along a watercourse or other natural or anthropogenic pathways; however, the new highway should be managed in a way that prevents the spread of INNS, which will constitute an offence under the WCA.</p> <p>Areas where INNS are eradicated during construction should be monitored as described in the CEMP for the required duration to ensure that re-growth does not occur.</p>	Yes

9.12 Assessment of significant effects

- 9.12.1 The prediction of impacts and the assessment of effects detailed in Table 9.11 to Table 9.13 has considered the avoidance and mitigation measures as detailed in Section 9.10. The potential for the Scheme to generate effects on important ecological features was evaluated using the methodology as detailed in Section 9.4. The screening assessment detailed in Section 9.11 determined that there are no likely significant effects on designated or non-designated sites.
- 9.12.2 The screening of likely significant effects in Section 9.11 has identified the following impacts on important ecological features (habitats and species) that have been taken forward for further assessment. Impacts and effects on biodiversity are reported for both the construction and operational phases of the Scheme.

Construction

Direct loss of Standing Water at the Thames River crossing and Appleford Siding, and direct loss of wetland habitats in the Hanson Restoration Area

- 9.12.3 Small sections of the unnamed lake at the Appleford Siding (WB07) will be lost. WB07 supports European Eel and Bullhead, together with nine other common fish species. This water body also supports uncommon species of aquatic macrophytes and macroinvertebrates, and the invasive non-native New Zealand Pigmyweed and Nuttall's Waterweed. This water body has been assessed as of District biodiversity importance. In the absence of compensatory habitat creation, the loss of sections of this water body represents a moderate adverse level of impact (change) (see Table 9.4: Level of impact and typical descriptions) resulting in a slight adverse effect which is not significant.
- 9.12.4 Small areas of three other water bodies will be lost at the Appleford Siding adjacent to WB07: unnamed ponds WB18, WB19 and WB32. These ponds were together found to support six fish species, uncommon species of aquatic macrophytes and macroinvertebrates, and also the invasive non-native curly waterweed in WB32. These water bodies have been assessed as of District biodiversity importance. In the absence of compensatory habitat creation, the loss of sections of this water body is considered to represent a moderate adverse level of impact, resulting in a slight adverse effect, which is not significant.
- 9.12.5 Small areas of the Culham finger lakes (WB16), supporting Roach, uncommon aquatic macroinvertebrates and macrophytes, and the invasive non-native New Zealand Pigmyweed and Nuttall's Waterweed, will be lost through construction of embankment and viaduct piers at the River Thames crossing. Areas to compensate fully for lost habitat will be created during outline design in the Hanson Restoration Area or adjacent to it. Therefore, this is considered a minor temporary adverse level of impact, resulting in a neutral adverse effect, which is not significant.
- 9.12.6 Direct loss of areas of standing water (see above), reedbed, wet woodland and wet flower-rich grassland approximating to MG4/ MG5 grassland in the Hanson Restoration Area, will occur due to the construction of embankment and viaduct piers. Areas to fully compensate for lost habitat will be created at outline design in the Hanson Restoration Area or adjacent to it. Therefore, this is a minor temporary adverse level of impact, resulting in a neutral effect which is not significant.

Direct impacts to running water – the River Thames and Moor Ditch, through shading and culverting

- 9.12.7 The River Thames will be crossed by a clear-span viaduct, with viaduct piers set back a minimum of 7 m from the banks. It is considered that the effects of shading on the river will be negligible, and embedded mitigation in relation to piling methods will ensure that significant effects to fish and other aquatic and riparian fauna are avoided. Therefore, this represents a negligible adverse level of impact, resulting in a neutral effect, which is not significant.
- 9.12.8 Moor Ditch will be crossed by the Scheme in the Didcot Science Bridge area. An existing culvert of approximately 74 m length will be removed and replaced with a culvert of 40 m length. The new culvert will be of a more ecologically sympathetic design with inverted bed to allow a natural river substrate to develop, and a mammal ledge, thereby facilitating longitudinal connectivity for aquatic and riparian species. The section no longer culverted will be subject to riparian planting to improve habitat quality and connectivity. Therefore, this is considered to represent a slight moderate beneficial effect, which is not significant.

Direct loss of a species rich and “important” hedgerow located towards the eastern end of the Clifton Hampden Bypass section of the Scheme

- 9.12.9 Construction activities are predicted to result in the direct loss of a species-rich (and important) hedgerow in the Clifton Hampden Bypass section and sections of other hedgerows that are neither species-rich nor important. Although, the majority of hedgerows across the Scheme will be avoided, where practicable, and replanting has been embedded within the Scheme design for creation of hedgerows. The loss of species-rich hedgerow is a permanent adverse effect, and the Scheme has embedded 3,840 m of native species rich hedgerow to mitigate this loss, however, these will take time to develop. Once hedgerows establish, it is predicted that the Scheme will be able to deliver a net gain in this habitat and that the overall impact will be beneficial.
- 9.12.10 Taking into account embedded protection measures and Scheme design to minimise the impact of construction activities causing direct loss of areas of hedgerows, it is assessed that this impact will be low adverse, which results in a temporary negligible effect whilst new hedgerows mature, that is not significant.

Direct loss of habitat supporting notable terrestrial invertebrate species and assemblages

- 9.12.11 Notable terrestrial invertebrate species and assemblages (of District importance) are associated with the habitats within the Didcot to Culham River Crossing section of the Scheme. Not one habitat or discrete area supports a notable assemblage, but rather the range of habitats present in this section of the Scheme allow for a diverse assemblage to be present. The Scheme will retain key areas, where practicable, for terrestrial invertebrates. However, construction activities are predicted to result in the direct loss of habitats supporting notable terrestrial invertebrates. Although, land has been embedded within the Scheme for creation of biodiverse habitats, these will take time to develop and therefore, there is likely to be a temporary (short-term) adverse effect on associated invertebrate species. However, significant areas of habitats will be retained and protected during construction with their quality improved (through positive management), which will help mitigate in the short-term for the loss of other areas and whilst mitigation areas develop. Once established it is anticipated that the Scheme will be able to deliver a net gain in this habitat required to support a range of terrestrial invertebrate species and assemblages and the overall effect will be beneficial.

- 9.12.12 Taking into account embedded protection measures and Scheme design to minimise the impact of construction activities causing direct loss of grassland habitats supporting notable terrestrial invertebrate species and assemblages, this level of impact (see Table 9.4) has been assessed as temporary minor adverse, resulting in a temporary neutral effect, which is not significant.

Direct loss of standing water habitat for fish at the Culham finger lakes and water bodies at the Appleford Siding

- 9.12.13 Small areas of habitat for fish will be lost from standing water bodies in the location of Appleford Siding: unnamed lake WB07, which supports European Eel and Bullhead, and unnamed ponds WB18, WB19 and WB32, and in the Culham finger lakes (WB16). These water bodies also support uncommon species of aquatic macroinvertebrates and macrophytes, as well as invasive non-native species (see below). Essential mitigation is included for fish rescue and translocations from the works areas, and if all water bodies are impacted simultaneously, a suitable receptor site for fish may need to be found. Due to the small areas of habitat to be lost and the dominance of common fish species, this is assessed as a minor temporary adverse level of impact, resulting in a slight adverse effect, which is not significant.

Direct loss of habitat on the breeding bird assemblage across the Scheme

- 9.12.14 The Scheme will look to retain key areas for breeding birds both within existing grassland areas, but also by ensuring that most boundary features (hedgerows, trees and woodland) are retained and protected during construction. However, construction activities are predicted to result in the direct loss of arable and wetland habitats supporting notable breeding bird assemblages. Although, land has been embedded within the Scheme design for creation of biodiverse habitats, these will take time to develop and therefore, there is likely to be a temporary (short-term) adverse effect on the breeding bird assemblage particularly those species associated with arable farmland. Significant areas of grassland habitats, along with boundary features (hedgerows, trees and woodland), will be retained and protected during construction with their quality improved (through positive management) – this will help mitigate in the short-term for the loss of other areas and whilst mitigation areas develop. Once established, it is predicted that the Scheme will be able to deliver a net gain in habitats required to support a diverse breeding assemblage similar to that currently present, but at an increased population size and the overall effect will be beneficial.
- 9.12.15 Taking into account embedded protection measures and Scheme design to minimise the impact of construction activities causing direct loss of habitats supporting a notable breeding bird assemblage, this level of impact (see Table 9.4) has been assessed as temporary minor adverse, resulting in a temporary slight adverse effect, which is not significant.

Disturbance to Little Ringed Plover, a species listed on Schedule 1 of the Wildlife and Countryside Act (WCA) (1981, as amended) in the Didcot to Culham River Crossing section

- 9.12.16 Construction activities have the potential to disturb Little Ringed Plover, a sensitive breeding species listed on Schedule 1 of the WCA and of District importance. Whilst populations of other species listed on Schedule 1 of the WCA are only of local importance (such as Barn Owl and Red Kite), temporary disturbance could also occur to such species too, where these are found in the vicinity of the Scheme. Pre-commencement surveys for sensitive breeding birds i.e. those listed on Schedule 1 of the WCA, will be undertaken in advance of the works commencing and through the CEMP, suitable measures will be delivered to ensure disturbance to sensitive breeding birds is avoided in line with the relevant legislation. There is likely to be a temporary (short-term) adverse effect from disturbance on Little Ringed Plover, if

construction is undertaken during the bird breeding season (March to August inclusive). However, through appropriate monitoring and management during construction, impacts will be avoided, in line with legislative requirements.

- 9.12.17 Taking into account embedded protection measures and delivery of a robust CEMP, the impact of construction activities causing disturbance to Little Ringed Plover, this level of impact (see Table 9.4) has been assessed as temporary minor adverse, resulting in a temporary neutral effect, which is not significant.

Loss of habitat and displacement of the non-breeding bird assemblage across the Scheme, particularly in the Didcot to Culham River Crossing section

- 9.12.18 The Scheme will look to retain key areas for non-breeding birds by minimising the amount of land take required to construct the Scheme. Most boundary features (hedgerows, trees and woodland) are retained and protected during construction. However, construction activities are predicted to result in the direct loss of arable and wetland habitats supporting notable non-breeding bird assemblages. Although land has been embedded within the Scheme design for creation of biodiverse habitats, these will take time to develop and therefore, there is likely to be a temporary, short-term adverse effect on the non-breeding bird assemblage particularly those species associated with arable farmland. However, as significant areas of grassland habitats, along with boundary features (hedgerows, trees and woodland), will be retained and protected during construction with their quality improved (through positive management), which will help mitigate in the short-term for the loss of other areas and whilst mitigation areas develop.
- 9.12.19 Construction activities are likely to result in the temporary displacement of non-breeding birds using wetland habitats in the Didcot to Culham River Crossing section.
- 9.12.20 Best practice construction methods as detailed in the CEMP will include implementation of measures to minimise noise, lighting and vibration disturbance to non-breeding birds such that disturbance to non-breeding birds in adjacent and retained habitats is minimised. However, there may be disturbance to birds using wetland habitats in the Didcot to Culham River Crossing. This level of impact has been assessed as temporary moderate adverse, resulting in a slight adverse effect, which is not significant.
- 9.12.21 Once established it is predicted that the Scheme will be able to deliver a net gain in habitats required to support a diverse non-breeding assemblage similar to that currently present. The overall impact will be minor beneficial, resulting in a slight beneficial effect that is not significant.

Habitat loss and fragmentation of habitats used by bats

- 9.12.22 Roads can have negative impacts on bats with landscape scale reductions in bat activity and diversity, reduced reproductive success and mortality from a barrier effect, habitat loss, reduced habitat quality and mortality through collisions with traffic. Effects on bats are considered in the short, medium and long term; 'short term' for bats is in the region of 1 to 2 years; 'medium term' >2 to 5 years; and 'long term' >5 years.
- 9.12.23 Three species of bat were recorded roosting within the survey area; these were Common Pipistrelle, Soprano Pipistrelle and Brown Long-eared bat. The survey results confirmed non-breeding bat roosts in trees and buildings.
- 9.12.24 These confirmed roosts were all day roosts used by small numbers of relatively common and widespread species of bat which are all assessed to be of Local importance.

- 9.12.25 Baseline bat activity associated with habitats within the vicinity of the Scheme was low and typical of the habitats present. Construction will result in the loss of habitats that are associated with the lower levels of bat activity.
- 9.12.26 The direct losses of foraging and commuting habitat where higher level of activity was recorded are localised, predominantly within the Clifton Hampden Bypass and Didcot to Culham River Crossing areas (see also Appendix 9.9: Bat survey report). The landscaping as part of the design for the Scheme includes replacement hedgerow planting. To make them accessible to bats, these habitats will be linked to existing areas of habitat that are known to be used by the local bat population. Once this replacement habitat has established, the magnitude of impact of habitat loss and gain during construction will be negligible adverse in the design year, leading to a neutral effect, which is not significant.
- 9.12.27 Construction activities resulting in increased levels of noise, vibration or light can lead to bats abandoning roosts or displacing them from foraging and commuting habitat. Bats are susceptible to disturbance impacts, particularly during the sensitive hibernation and maternity period. There is currently no evidence of hibernation or maternity roosts within the Site.
- 9.12.28 Standard construction working measures detailed in the CEMP will reduce any disturbance impacts as a result of construction activity. This also includes measures to avoid light-spill upon retained boundary habitats that may be used for foraging or commuting. The magnitude of impact relating to possible disturbance impacts will be negligible adverse during the construction period, leading to a neutral effect which is not significant.
- 9.12.29 The loss of hedgerow habitat will lead to the fragmentation of interconnected habitats used by the local bat population. Levels of bat activity are generally low across the habitats that are contained within the Site.
- 9.12.30 The mix of hedgerows, grassland, scrub and wetland created as part of the Scheme will provide corridors of connecting habitat running in a north-south direction through the Scheme. These will maintain and, in some instances improve upon the linkages to the retained areas of habitat, including those known to be regularly used by bats, and will therefore further reduce the impact of fragmentation impacts upon the local bat population. Connectivity around the margins of the Scheme and into the wider landscape will also be maintained.
- 9.12.31 The habitat loss will result in the fragmentation of habitats. The level of impact (change) (see Table 9.4) is minor adverse, resulting in a slight adverse effect, which is not significant.
- 9.12.32 The establishment of habitats that link to adjacent features used by bats will, by the design year, have established and will reduce the magnitude of impact to negligible adverse and the effect to neutral.

Potential for the spread of invasive non-native species (INNS) during construction

- 9.12.33 Invasive non-native species have been identified in a number of water bodies and riparian habitats across the Scheme. These include Curly Waterweed, Himalayan Balsam, New Zealand Pigmyweed and Nuttall's Waterweed in the water bodies above to be directly impacted, as well as records of American Signal Crayfish, Chinese Mitten Crab and Zebra Mussel close to the Scheme. The CEMP will detail appropriate best-practice mitigation to prevent the spread of invasive species and to ensure biosecurity protocols are implemented throughout construction. There may be opportunities to eradicate INNS from some work areas, in which case this will represent a moderate beneficial effect to these specific areas. With the

implementation of measures in the CEMP and, or Biosecurity and Invasive Non-Native Species Management Plan across the entirety of the Scheme, this is assessed as a minor adverse level of impact, resulting in a slight adverse effect, which is not significant.

Operation

9.12.34 The screening assessment, taking account of embedded mitigation as detailed in Section 9.10, determined that there are no likely significant effects on habitats or species during operation of the Scheme, with the exception of invasive non-native species – this issue is considered below.

Potential for the spread of Invasive Non-Native Species (INNS) during operation

9.12.35 INNS may be spread through the operation of the new highways network, for example the dispersal of seeds through traffic movement and associated air turbulence, on tyres (especially where INNS are present adjacent to laybys etc.), or by vegetation management teams. Facilitating the spread of INNS in the wild will constitute an offence under the Wildlife and Countryside Act 1981 (as amended). Therefore, mitigation measures, as detailed in a Biosecurity and Invasive Non-Native Species Management Plan and/ or Operations Biosecurity Management Plan should be implemented to prevent the spread of INNS and respond appropriately to their presence. This will include, for example, integrating biosecurity awareness into roadside management (including vegetation management) and establishing periodic monitoring, allowing for appropriate response and control. With the implementation of such measures, this is assessed as a minor adverse level of impact, resulting in a slight adverse effect, which is not significant.

9.13 Summary of magnitude of impact and significance of effects

9.13.1 Table 9.14 summarises the importance, sensitivity (value) of important ecological features, and the impacts and effects resulting from construction and operation of the Scheme.

Table 9.14: Summary of Magnitude of Impact and Significance of Effects

Receptor	Sensitivity (Importance)	Description of Impact	Magnitude of Impact	Level of effect	Significant (Yes / No)
Freshwater Ponds and Eutrophic Standing Water	Low (district)	Loss of habitat	Moderate adverse	Slight	No
Freshwater: Rivers with running water (watercourses including 'ditches' with running water)	Low (district)	Shading and culverting of watercourses	River Thames: Negligible adverse Moor Ditch: Moderate Beneficial	Neutral N/A	No
Hedgerows	Medium (county)	Loss of Habitat	Minor adverse	Neutral	No
Terrestrial invertebrate species and assemblages	Low (district)	Loss of Habitat	Minor adverse	Neutral	No
Fish – European Eel and Bullhead	Medium (up to county)	Loss of standing water habitat	Minor adverse	Slight	No

Receptor	Sensitivity (Importance)	Description of Impact	Magnitude of Impact	Level of effect	Significant (Yes / No)
Breeding birds assemblage	Medium (county)	Loss of habitat	Minor adverse	Slight	No
Population of breeding Little Ringed Plover	Low (district)	Loss of habitat. Disturbance when breeding	Minor adverse	Neutral	No
Non-breeding (wintering) birds	Medium (county)	Loss of habitat	Moderate adverse	Slight	No
Bats	Medium (county)	Loss of and fragmentation of habitats used by commuting and foraging bats Loss of roosting habitat	Minor adverse	Slight	No
Invasive non-native species	N/A	Potential for invasive non-native species to be spread during construction and operation	Minor adverse	Slight	No

9.14 Monitoring

9.14.1 The Scheme is not anticipated to result in any residual significant effects once operational and therefore no monitoring of significant effects is required. However, on-going monitoring is recommended for INNS during the Scheme operational phase as detailed below. The OLBMP will detail on-going monitoring requirements in terms of monitoring compliance with the final approved OLBMP.

Invasive Non-Native Species (INNS)

9.14.2 In areas where INNS are treated and eradicated during construction, these should be monitored during Scheme operation to ensure that there is no re-growth of INNS. This will be completed for an appropriate duration as detailed in the CEMP and/ or Biosecurity and Invasive Non-Native Species Management Plan.

9.14.3 Periodic monitoring along the new highway should be undertaken, as detailed in a Biosecurity and Invasive Non-Native Species Management Plan and/ or Operations Biosecurity Management Plan, to identify new growth of INNS and implement appropriate treatment and control measures. Prevention is far more cost effective than waiting for large areas of INNS such as Japanese knotweed, giant hogweed or Himalayan balsam to become established, and the associated liabilities that this leads to.

9.15 Summary

9.15.1 A range of biodiversity mitigation measures have been defined as detailed in Section 9.10. In addition, the Scheme has been designed on the principles of no net loss and will achieve a net gain in habitats of biodiversity value, which will be of benefit to a wide range of protected species.

9.15.2 It is anticipated that the Scheme will have a slight adverse effect on the following ecological receptors (as detailed in Table 9.14):

- Freshwater Ponds and Eutrophic Standing Water;
- Fish – European Eel and Bullhead;
- Invasive non-native species;
- Breeding bird assemblage across the Scheme;
- Non-breeding bird assemblage across the Scheme; and
- Bats across the Scheme.

9.15.3 Overall, the Scheme is expected to result in a slight positive effect in the medium to long term, once habitats have matured, as a result of the overall biodiversity net gain.

9.16 References

- Ref 9.1 AECOM (2020) Didcot Garden Town HIF1 Scheme. EIA Scoping Report. Chapter 9
- Ref 9.2 HMSO. (2017). The Conservation of Habitats & Species Regulations. <http://www.legislation.gov.uk/ukxi/2017/1012/contents/made>
- Ref 9.3 Council Directive 92/43/EEC on the conservation of natural habitats and of wild fauna and flora. European Commission (1992). <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=celex%3A31992L0043>
- Ref 9.4 Directive 2009/147/EC of the European Parliament and of the Council of 30 November 2009 on the conservation of wild birds. European Commission (2009). <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A32009L0147>
- Ref 9.5 Ramsar Convention on Wetlands of International Importance especially as Waterfowl Habitat. United Nations Educational, Scientific and Cultural Organization. (1971). http://portal.unesco.org/en/ev.phpURL_ID=15398&URL_DO=DO_TOPIC&URL_SECTION=201.html
- Ref 9.6 HMSO. (1981). Wildlife & Countryside Act 1981 (as amended). <https://www.legislation.gov.uk/ukpga/1981/69>
- Ref 9.7 HMSO. (2000). Countryside and Rights of Way Act 2000. <https://www.legislation.gov.uk/ukpga/2000/37/contents>
- Ref 9.8 EC. (2000). Directive 2000/60/EC of the European parliament and of the council of 23 October 2000 establishing a framework for Community action in the field of water policy. Official Journal of the European Communities, Brussels
- Ref 9.9 Water Environment (WFD) (England and Wales) Regulations 2017 (SI 2017/407). Available at: <https://www.legislation.gov.uk/ukxi/2017/407/contents/made> [Accessed: 10 March 2021]
- Ref 9.10 HMSO. (2006). Natural Environment and Rural Communities Act 2006. <https://www.legislation.gov.uk/ukpga/2006/16/contents>
- Ref 9.11 UK Post-2010 Biodiversity Framework. Joint Nature Conservation Committee and Department for Environment, Food and Rural Affairs (2012). http://jncc.defra.gov.uk/pdf/UK_Post2010_Bio-Fwork.pdf
- Ref 9.12 HMSO. (1992). Protection of Badgers Act 1992. <https://www.legislation.gov.uk/ukpga/1992/51/contents>
- Ref 9.13 HMSO. (1997). Hedgerow Regulations 1997. <http://www.legislation.gov.uk/ukxi/1997/1160/contents/made>
- Ref 9.14 Salmon and Freshwater Fisheries Act 1975. Available at: <https://www.legislation.gov.uk/ukpga/1975/51> (Accessed: 10 March 2021).

- Ref 9.15 The Eels (England and Wales) Regulations 2009 (SI 2009/3344). Available at: <https://www.legislation.gov.uk/ukxi/2009/3344/contents/made> (Accessed: 10 March 2021).
- Ref 9.16 EC. (2007). Council Regulation (EC) No 1100/2007 of 18 September 2007 establishing measures for the recovery of the stock of European eel. Official Journal of the European Union, Brussels.
- Ref 9.17 HMSO. (2006). Animal Welfare Act 2006. http://www.legislation.gov.uk/ukpga/2006/45/pdfs/ukpga_20060045_en.pdf
- Ref 9.18 HMSO. (1996). Wild Mammals (Protection) Act 1996. <https://www.legislation.gov.uk/ukpga/1996/3/contents>
- Ref 9.19 HMSO (2019) The Invasive Alien Species (Enforcement and Permitting) Order 2019. <https://www.legislation.gov.uk/ukxi/2019/527/contents/made>
- Ref 9.20 EC (2014). Regulation (EU) 1143/2014 on Invasive Alien Species. https://ec.europa.eu/environment/nature/invasivealien/index_en.htm [Accessed May 2021]
- Ref 9.21 National Planning Policy Framework. Department for Communities and Local Government (2021)
- Ref 9.22 National Planning Practice Guidance. Ministry of Housing, Communities and Local Government (2016-2018). <https://www.gov.uk/government/collections/planning-practice-guidance>
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Annex 6 – Appendix 9.5: Reptile Survey Report



REVISED

Didcot Garden Town HIF 1 Scheme

Environmental Statement

Volume III

Appendix 9.5: Reptile Survey Report

October 2022

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Executive Summary

AECOM was instructed by Oxfordshire County Council (the client) to undertake surveys of reptile presence or likely absence, for the proposed Didcot Garden Town HIF 1 Scheme (hereafter referred to as the Scheme). The Preliminary Ecological Appraisal (PEA) (AECOM, 2020) for the Scheme, undertaken in January 2020, identified that there was habitat within the Scheme boundary (the Site) that was suitable to support reptiles and that surveys were required to determine the potential impacts of the Scheme on reptiles, if present. Therefore, AECOM was instructed to undertake reptile surveys within the Site and an appropriate survey buffer (referred to hereafter as the survey area) to determine presence or likely absence of reptiles.

The reptile surveys undertaken in 2020 identified the presence of low numbers of two reptile species (Common Lizard and Grass Snake) within the A4130 Widening site and within the Didcot to Culham River Crossing site.

For both Common Lizard and Grass Snake, a very low population (local importance) was observed within the Site in localised areas.

Any development within Areas 2, 4 and 5 (see Figure 2) has the potential to impact on reptile populations. In the absence of appropriate mitigation, these impacts will be:

- risk of incidental injury and mortality to Common Lizard and Grass Snake during the construction of the Scheme;
- permanent loss of foraging habitat, used by two species of reptile; and
- temporary disturbance of foraging reptiles, potentially using arable field margins, during construction of the Scheme.

Both Common Lizard and Grass Snake are listed under Schedule 5 of the Wildlife & Countryside Act 1981 (as amended), which prohibits intentional injuring or killing of a reptile. Therefore, through the implementation of a mitigation strategy, formalised through a Construction and Environment Management Plan (CEMP), the potential for killing and injuring of reptiles will be avoided. Mitigation is required to:

- ensure compliance with relevant legislation; and
- avoid impacts that will give rise to a potential “significant effect”, therefore contrary to planning policy and biodiversity obligations of the NERC Act 2006.

1. Introduction

1.1 Background

- 1.1.1 AECOM was instructed by Oxfordshire County Council (the client) to undertake surveys of reptile presence, or likely absence, for the proposed Didcot Garden Town HIF 1 Scheme (hereafter referred to as the 'Scheme'). The Preliminary Ecological Appraisal (PEA) (AECOM, 2020¹) for the Scheme, undertaken in January 2020, identified that there was habitat within the Scheme boundary (the Site) that was suitable to support reptiles and that surveys were required to determine the potential impacts of the Scheme on reptiles, if present. Therefore, AECOM was instructed to undertake reptile surveys within the Site and an appropriate survey buffer (referred to hereafter as the survey area) to determine presence or likely absence of reptiles.
- 1.1.2 The information described in this report provides a complete baseline which will be used to inform the Ecological Impact Assessment (EclA) to be included in the Environmental Statement for the Scheme.

1.2 The Scheme

- 1.2.1 The Scheme is located to the west and north of Didcot, Oxfordshire, between the Milton Interchange Service Area in the west, and the B4015 north-east of the village of Clifton Hampden (see Figure 1).
- 1.2.2 The Scheme comprises the following four improvement sites:
- A4130 Widening;
 - Didcot Science Bridge;
 - Didcot to Culham River Crossing; and
 - Clifton Hampden Bypass.

1.3 Site Descriptions

- 1.3.1 The land use within the Scheme boundary is a mixture of agricultural land, with an active power station site, an old power station site (Dicot A Power station) currently undergoing redevelopment, an industrial estate, a live landfill site and a quarry. Multiple waterbodies are also present within the Site.
- 1.3.2 A summary description of the habitats within the Site is provided below and a more detailed description of the habitats is provided in the PEA report (AECOM, 2020¹). The Scheme layout is presented in Figure 1.

A4130 Widening

- 1.3.3 This part of the Scheme comprises a dual-carriageway from a point approximately 250 m east of Milton Interchange at the junction with Milton Gate, eastwards for approximately 1.6 km to the proposed eastern roundabouts connecting into the future development at Valley Park and the Didcot Science Bridge scheme. Dualling of the A4130 will consist of modifications to the existing single carriageway, establishment of a central reserve and provision of two additional lanes to the south. The existing single carriageway will form the eastbound carriageway towards Didcot and the newly constructed lanes will form the westbound carriageway to the A34 Milton Interchange.

¹ AECOM. (2020). Didcot Garden Town Preliminary Ecological Appraisal.

- 1.3.4 A four-arm roundabout at the western end of the scheme is proposed to serve an area located immediately south-west of this roundabout, which has been subject to approved outline development proposals for Roadside Services and Facilities (planning application reference P15/V2880/O). This Backhill roundabout will also provide access to the North West of Valley Park strategic housing allocation site, to the south and east.
- 1.3.5 A new signalised T-junction is proposed approximately 600 m east of the Backhill roundabout which will provide access to the 'Valley Park' strategic housing allocation site, which is the subject of an outline planning application P14/V2873/O, with a resolution to grant permission subject to Section 106 agreement.
- 1.3.6 A new three-arm 'Old A4130' roundabout is proposed 600 m east of the signalised junction. The eastern arm will be the current A4130, that is to be retained as a single carriageway, providing access into Didcot. The south-eastern arm is proposed to be an approximately 260 m single carriageway road connecting to the new Didcot Science Bridge three-arm roundabout. The Didcot Science Bridge roundabout will provide access to the new Didcot Science Bridge to the north, and Valley Park housing development to the south. Access at this location is already being secured through the outline planning application for Valley Park.
- 1.3.7 The road corridor will also include a bi-directional segregated cycleway and a footway on the southern side of the dual carriageway, as well as several formal crossing points and buffer.

Didcot Science Bridge

- 1.3.8 This section of the proposed scheme is a new north-south bridge from the proposed Didcot Science Bridge roundabout, over the existing A4130, the Great Western Railway Mainline, and Milton Road, into the former Didcot A Power Station site. The proposed Didcot Science Bridge Link Road (SBLR) will connect the bridge with the A4130 Northern Perimeter Road north of the Purchas Road/Hawksworth roundabout, close to the existing Southmead Industrial Estate.
- 1.3.9 Planning permission (P15/S1880/O and P15/V1304/O) has been granted for a mixed-use development in the power station site and this includes the reservation of land for the SBLR and Didcot Science Bridge. There will be various embankments associated with the road bridge approaches, and they will vary in width. The road bridge will be approximately 16 m in width, including a single carriageway, a bi-directional segregated cycleway and a footway on one side of the road.
- 1.3.10 The SBLR will be a single carriageway, with segregated footways and bi-directional cycleways on both sides of the road for the majority of its length. Various accesses are planned off the road alignment for the proposed development in the power station site (P15/S1880/O and P15/V1304/O). Other works required include the diversion of a watercourse which will cross underneath the new road in a culvert, and provision of formal Non-Motorised User (NMU) crossings, including a toucan crossing where a National Cycle Route crosses the road alignment.

Didcot to Culham River Crossing

- 1.3.11 This section of the Scheme will provide a new 3.6 km single carriageway link road west of the Cherwell Valley railway line and NMU facilities between Didcot and Culham. It will extend north from the A4130 Collett roundabout in Didcot to the A415 Abingdon Road west of Culham Science Centre.

- 1.3.12 An improved and enlarged four-arm A4130 Collett roundabout will be provided. This will connect with the Didcot Science Bridge scheme to the west, the Didcot to Culham Link Road to the north, Southmead Industrial Estate to the south and to the existing A4130 to the east.
- 1.3.13 Agricultural land, private residential properties, a pallet and wood recycling centre, Sutton Courtenay landfill, and Hanson aggregate operations all lay north of Collett roundabout. A Local Development Order is being prepared to enable this agricultural area to become an employment site called D-Tech, in this “Didcot Growth Accelerator” Enterprise Zone.
- 1.3.14 North of Collett roundabout to the southern edge of Sutton Courtenay Landfill the new single carriageway road will be approximately 20 m wide with verges, hard strips, and segregated footways and bi-directional cycleways on both sides. Two accesses, one on either side of the proposed road, will be provided to maintain access to the adjacent agricultural land, private residential properties and businesses.
- 1.3.15 The road will extend north along the east edge of Sutton Courtenay Landfill. In this area on the west side of the road a 3.0 m shared use bridleway is provided with the segregated footways and bi-directional cycleways continuing on the east side. On the west side of the road a new priority junction and access road will be provided to Sutton Courtenay Landfill (operated by FCC Environment), and Hanson Aggregates and Appleford Railway Sidings (operated by Hanson). This will replace the existing Portway Road access further north.
- 1.3.16 The road extends north to Appleford railway sidings passing along the eastern boundary of a large surface water management pond. The Cherwell Valley Line and Appleford Level Crossing is located to the east of the proposed road. Appleford Sidings bridge will be provided to bridge the road over the railway sidings and connect the north and south approach embankments.
- 1.3.17 The road will traverse 90 Acre Field, an area of restored historic landfill, and link to the B4016 to the west of Appleford. A priority T-junction with a ghost island right turn lane will be provided at this location. Sutton Courtenay roundabout will be provided to the north-west with a severed section of the B4016 retained to be a footway cycleway. Sutton Courtenay roundabout will be an at grade, three-arm roundabout providing access to the crossing over the River Thames whilst maintaining links between Appleford, Sutton Courtenay and the surrounding areas.
- 1.3.18 Extending north from Sutton Courtenay roundabout, a 336-metre approach viaduct will be provided to cross the River Thames flood plain with a 155 m bridge provided to span over the River Thames. The River Thames is navigable at this location the bridge height has been designed to accommodate river traffic.
- 1.3.19 North of the River Thames, the new link road will continue north through existing agricultural land towards A415 where a new at grade four-arm roundabout will be constructed to connect with the A415 and a new development to the north which is an allocated site in the Local Plan.

Clifton Hampden Bypass

- 1.3.20 The Clifton Hampden Bypass will re-route traffic on the A415 around the village of Clifton Hampden, which currently experiences a large amount of through traffic as people travel between the A415 to A4074 northwest of the village.
- 1.3.21 The link road will provide a bypass northwest of Clifton Hampden village and will be approximately 2.2 km long. The new road will be a single carriageway with adjacent

hard strips, grass verges, and a shared-use cycleway / footway. The bypass will be aligned in a south-west to north-east direction and will be a single carriageway, approximately 9.3 m in width including hard strips.

- 1.3.22 The proposed works also include the construction of a large four-arm roundabout at the western end of the Scheme, providing access to the SODC Local Plan allocated housing site, a railway station and Leda Properties owned farmland / businesses north of Culham Science Centre (CSC) coming off the northern arm, and CSC on the northeast arm. A new T- junction with a ghost island right turn lane connecting the existing B4015 Oxford Road is proposed at the eastern extent of the Scheme.
- 1.3.23 The current alignment of the A415 will be realigned north into the proposed bypass, with the existing A415 west of this point as a “no through road” to serve existing residences. All roundabout exits will include one lane, except the eastern bypass arm which will have two lanes. The roundabout will have a segregated left turn lane from the eastern bypass arm to the western A415 arm.
- 1.3.24 Station Road will be realigned and will join with a new entrance to the industrial properties located northwest of the roundabout. The existing main access into the CSC will be converted into a shared use footway / cycleway. The northeast roundabout arm will provide access to CSC via the main gate, and a stub towards Perimeter Road for a potential future connection to be delivered by CSC.
- 1.3.25 The A415 connection road east of the roundabout will provide access from the bypass to the existing A415 and Clifton Hampden.
- 1.3.26 Along the bypass, four access points will be included on the south side of the road; one will link to the existing alignment of the A415 (as described); one to a Thames Water sewage treatment works; and one to an existing farm track. The bypass will tie-in with the current alignment of the B4015 Oxford Road (east) and a T-junction with a ghost island right turn will be included, to provide access to the current alignment of the B4015 Oxford Road (south-west).
- 1.3.27 On the north side of the road, two accesses will be created; one will be a new second access into the CSC, the other will link with an existing farm track.

1.4 Scope of Report

- 1.4.1 The objective of the reptile survey, reported in this document, is to determine the presence or likely absence of reptiles in areas of suitable habitat located within the Scheme boundary.
- 1.4.2 This report includes the following information:
- relevant legislation and policy;
 - methods for desk and field-based assessments;
 - limitations to the surveys undertaken and any assumptions made as a result of incomplete data;
 - survey results;
 - the approach for determining the nature conservation importance of reptile populations recorded during the assessments; and
 - conclusions.

2. Legislative and Policy Framework

2.1 Relevant Legislative Context

- 2.1.1 The four reptile species that could be found within or in the neighbourhood of the Site are typically referred to as ‘widespread’ (despite the fact that all of Britain’s native reptile species are declining to some degree): Adder (*Vipera berus*), Grass Snake (*Natrix helvetica*), Common Lizard (*Zootoca vivipara*) and Slow Worm (*Anguis fragilis*). These four species are afforded protection under Section 9(1) and (5) only, under Part 1 of the Wildlife and Countryside Act (WCA) 1981 (as amended²), which makes it an offence to:
- intentionally kill or injure a reptile;
 - sell, offer or expose for sale, or to possess or transport for sale alive or dead reptile or any part of or anything derived from a reptile; or
 - publish or cause to be published any advertisement likely to be understood as conveying that a person buys or sells, or intends to buy or sell, any of those things.
- 2.1.2 In accordance with this legislation, care must be taken to ensure that reptiles are not killed or injured during project works. Sensitive timings and methods of vegetation clearance and construction works are essential to minimise the risk to reptiles and the risk of causing an offence under the legislation.
- 2.1.3 There are no licensing provisions within the WCA for development activities affecting these species. However, developers are expected to take adequate precautions to avoid breaches of the legislation, including undertaking adequate surveys and mitigation to avoid or minimise the risk of killing or injuring reptiles.
- 2.1.4 Note, this information does not cover the Sand Lizard *Lacerta agilis* or the Smooth Snake *Coronella austriaca*, which are both fully protected under the Conservation of Habitats and Species Regulations 2017. The Site lies well outside the known range of Sand Lizard and Smooth Snake and given that the Site lacks the necessary habitat to support these species, neither are considered further in this report.
- 2.1.5 Section 40 of the Natural Environment and Rural Communities (NERC) Act 2006³ places a duty on all public bodies to have regard “so far as is consistent with the proper exercise of those functions, to the purpose of conserving biodiversity.” Section 41 of the Act requires the Secretary of State to publish a list of habitats and species which are of principal importance for the conservation of biodiversity in England. The list has been drawn up in consultation with Natural England, as required by the Act, and all four species of reptile that could be found within or in the neighbourhood of the Scheme are listed as species of principal importance.

2.2 National and Local Planning Policy

- 2.2.1 National and local planning policy relevant to nature conservation is provided in detail in the PEA report for the Scheme (AECOM, 2020¹).

² Anon, 1981. Wildlife & Countryside Act 1981. HMSO.

³ Anon, 2006. The Natural Environment and Rural Communities Act. HMSO, London.

2.3 Priority Species

- 2.3.1 The NERC list of Species of Principal Importance is used to guide decision-makers such as public bodies, including local and regional authorities, in implementing their duty under Section 40 of the NERC Act (2006³); under Section 40 every public authority (e.g. a local authority or local planning authority) must, in exercising its functions, have regard, so far as is consistent with the proper exercise of those functions, to the purpose of conserving biodiversity.
- 2.3.2 In addition, with regard to those species on the list of Species of Principal Importance listed under Section 41, the Secretary of State must:
- “(a) take such steps as appear to the Secretary of State to be reasonably practicable to further the conservation of the living organisms and types of habitat included in any list published under this section, or*
- (b) promote the taking by others of such steps.”*
- 2.3.3 The UK Biodiversity Action Plan (UKBAP⁴) was launched in 1994 and established a framework and criteria for identifying species and habitat types of conservation concern. From this list, action plans for priority habitats and species of conservation concern were published and have subsequently been succeeded by the UK Post-2010 Biodiversity Framework (July 2012⁵). The UK Post 2010 Development Framework is relevant in the context of Section 40 of the Natural Environment and Rural Communities (NERC Act) 2006, meaning that Priority Species and Habitats are material considerations in planning. These habitats and species are identified as those of conservation concern due to their rarity or a declining population trend.
- 2.3.4 Common Lizard, Grass Snake, Slow Worm and Adder were included in the UK Biodiversity Action Plan (UKBAP) as priority species in September 2007 and are included as Species of Principal Importance in England under Section 41 of the NERC Act (2006) meaning that they are of material consideration in planning.

2.4 Local Biodiversity Action Plan

- 2.4.1 No specific species action plans are listed within the Oxfordshire Biodiversity Action Plan, instead, a list of all UK BAP priority species found within Oxfordshire is provided on the Oxfordshire Nature Conservation Forum (ONCF) website (ONCF, 2010⁶⁷).

⁴ Anon. (2008). UK Biodiversity Action Plan.

⁵ JNCC, UK Post-2010 Biodiversity Framework, 2012, available at <http://jncc.defra.gov.uk/page-6189> [Accessed October 2020].

⁶ Oxfordshire Nature Conservation Forum. (2010a). Oxfordshire's Biodiversity Action Plan and Conservation Target Areas. Available at:

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⁷ Oxfordshire Nature Conservation Forum. (2010b). Biodiversity. Available at: <http://www.oncf.org.uk/biodiversity/biodiversity.html> [Accessed October 2020].

3. Methods

3.1 Desk Study

- 3.1.1 A data search was carried out in December 2019, through Thames Valley Environmental Records Centre (TVERC), to obtain records of reptiles within a 2 km radius of the Site and from within the last ten years of the request date.
- 3.1.2 Only records up to ten years old were considered within the assessment, as any records older than ten years are unlikely to be still representative of reptiles in the local area.

3.2 Field Survey

Survey area

- 3.2.1 The survey area included suitable terrestrial habitat for reptiles within the Site, which included ephemeral/short perennial vegetation, scrub edges, semi-improved grassland and ditches. A total of 11 areas (collectively referred to as the survey area) of suitable reptile habitat were identified across the Site (see Figure 2).

Habitat Suitability Assessment

- 3.2.2 A Habitat Suitability Assessment (HSA) for reptiles was undertaken using existing desk-based study data, a review of the Phase 1 Habitat map and aerial photographs. The characteristics for assessing the suitability of habitat for reptiles included:
- location in relation to species range;
 - vegetation structure;
 - insolation (sun exposure);
 - aspect;
 - topography;
 - connectivity to nearby good quality habitat;
 - refuge opportunity;
 - hibernation potential;
 - disturbance; and
 - egg-laying site potential (Grass Snake only).
- 3.2.3 For each habitat type or discrete area, the output of the HSA graded each habitat for its potential to support reptiles, based on the above factors. Any area that was graded as good or exceptional habitat was then subject to further reptile presence / absence surveys. Table 3-1 shows the definitions used in the HSA and habitat grading.

Table 3-1. Habitat suitability assessment for reptiles

Habitat Grading	Definition
Poor	Habitat which is unfavourable for reptiles based on most of the habitat assessment characters listed above or is limited in size and highly isolated from other areas of suitable habitat.
Good	Habitat which is favourable or sub-optimal for many of the habitat assessment characters listed above; or is sub-optimal for some of

Habitat Grading	Definition
	the characters and has good connectivity with areas of more suitable habitat.
Exceptional	Habitat which is favourable for reptiles based on most of the habitat assessment characters listed above.

Reptile presence or likely absence

3.2.4 The field surveys utilised two recognised methods to record reptile presence or likely absence within the Site:

- refugia surveys; and
- visual observation of banks and, or other, suitable habitat within the Site.

Refugia Surveys

3.2.5 Refugia surveys were carried out in September 2020. All refugia surveys were carried out in accordance with Froglife's Advice Sheet 10 for Reptile Surveys⁸ and Natural England's Standing Advice Sheet for Reptiles⁹.

3.2.6 Artificial refugia, in the form of sheets of bitumen roofing felt, measuring approximately 0.5 m² in area, were placed in likely basking spots for reptiles. These areas included un-shaded patches next to cover, suitable grassland and adjacent to potential hibernation sites such as piles of rubble, logs, rabbit burrows and near vegetation waste such as arisings from grass cuttings and wood chips.

3.2.7 A total of 273 refugia sheets were distributed across the survey area (see Figure 2) and the number of refugia sheets placed in each survey area are displayed in Table 3-2. The density of sheets was based on guidance within Froglife's Advice Sheet 10.

Table 3-2. Number of artificial refugia placed within each survey area

Survey Area	Size (ha) of area	Number of artificial refugia sheets	Density of refugia per hectare
1	2.66	20	7.5
2	6.61	76	11.5
3	2.82	30	10.6
4	2.38	22	9.2
5	1.31	20	15.2
6	0.76	10	13.2
7	0.26	10	38.5
8	0.37	10	27
9	0.82	35	42.7
10	0.44	10	22.7
11	0.84	30	35.7

3.2.8 Following placement of sheets in each survey area on 13th August 2020, the artificial refugia were left in situ for two weeks to settle in and were then checked on seven separate occasions between 9th and 25th September 2020, being removed from the Site on 5th October 2020. Any existing hibernation sites within the survey area, such

⁸ Froglife, 1999. Froglife Advice Sheet 10, Reptile Survey.

⁹ Ref 8-10 Natural England, 2015. Reptiles: surveys and mitigation for development projects. Available at: <https://www.gov.uk/guidance/reptiles-protection-surveys-and-licences> [Accessed October 2020].

as rubble piles or wood piles, were, where possible, also searched for reptiles during checks of artificial refugia.

- 3.2.9 Reptile activity is greatly influenced by weather conditions, with reptiles most likely to use artificial refugia in temperatures of between 9°C and 18°C and in hazy or intermittent sunshine with light winds⁸. The optimal survey period for reptiles (as recommended in the Herpetofauna Worker's Manual (2003¹⁰) is April, May and September. Reptiles are also active in June, July and August; however, they will need to spend less time basking so may be more difficult to find¹⁰.
- 3.2.10 The age and sex of each reptile found was also recorded using the Amphibian and Reptile Conservation Trust (ARC) Reptile Identification Guide (2016¹¹).
- 3.2.11 The dates of reptile surveys and weather conditions during these surveys are shown in Table B.1 in Appendix B. All surveys were conducted by experienced AECOM ecologists.

Visual Inspections

- 3.2.12 Whilst carrying out other ecological surveys across the Site, any areas of suitable reptile habitat including areas with artificial refugia within the reptile survey areas were searched in order to 'spot' basking Common Lizards. This species will often sit on top of grass tussocks, debris and felts and will quickly move from sight upon disturbance. Consequently, spotting this species can be more effective than searching under artificial refugia. Common Lizards are often very territorial and will often reuse favourite basking sites (2000¹²). Once these sites are known, spotting can become a relatively successful method of lizard recording.

Population Assessment

- 3.2.13 Where reptiles are present, estimating population sizes of reptiles can be undertaken using guidance within Froglife's Advice Sheet 10⁸. This advice sheet provides a simple means of evaluating a species population as 'low', 'good', or 'exceptional' based on the maximum number of adult reptiles (of each species) recorded during a single visit (see Table 3-3 below).

Table 3-3. Population estimates of reptile (taken from Froglife, 1999⁸)

Species	Low Population	Good Population	Exceptional Population
Adder	<5	5 – 10	>10
Grass Snake	<5	5 – 10	>10
Common Lizard	<5	5 – 20	>20
Slow Worm	<5	5 – 20	>20

- 3.2.14 This method of population size estimate uses the assumption of a reptile survey using a density of 10 reptile sheets per hectare, although it can be difficult to determine a population size through interpretation of data using peak counts and densities. An average score across all survey visits will provide a more robust estimate of the population size of each reptile species present within suitable on-site habitat.

¹⁰ Gent, T. and Gibson, S., 2003. Herpetofauna Workers' Manual. Joint Nature Conservation Committee.

¹¹ ARC, 2016. Reptile Identification Guide. Amphibian and Reptile Conservation Trust.

¹² Beebee, T. and Griffiths, R., 2000. Amphibians and Reptiles. Collins New Naturalist Library, Book 87.

3.3 Limitations

Desk Study

- 3.3.1 The aim of a desk study was to help characterise the baseline context of the Site and provide valuable background information that will not be captured by site surveys alone. Information obtained during the desk study was dependent upon people and organisations having made and submitted records for the area of interest. As such, a lack of records for reptiles did not necessarily mean that reptiles do not occur in the study area. Likewise, the presence of reptiles did not automatically mean that these still occur within the area of interest or were relevant in the context of the Scheme.

Field Survey

- 3.3.2 Only five survey visits were carried out in Area 6 due to the refugia sheets being removed from the Site by a member of the public. Whilst fewer surveys were undertaken within these areas than the recommended seven visits, the reduction in survey effort is not a significant limitation as the survey area is subject to human disturbance and agricultural management. Furthermore, no reptiles were recorded during the surveys that were undertaken and so the likelihood of numbers of reptiles being present within these areas is low. However, it is acknowledged that small numbers of reptiles (namely Grass Snake and Common Lizard, based on the quality of habitat within these areas) may occur in these areas and consideration of this will be taken forward when designing mitigation for the Scheme.
- 3.3.3 It is acknowledged that some of the surveys were undertaken on consecutive days and that surveyors may have caused some disturbance, thus reducing reptile detection. However, from the overall spread of surveys, numbers of individuals recorded remained low and the programme of survey dates did not significantly influence the detection and recording of reptiles.
- 3.3.4 The density of sheets per hectare in survey areas 1 and 4 (see Table 3-2) was just below the recommended 10 sheets per hectare, to establish population estimates. However, this is not seen as a significant limitation to the efficacy of the survey results as no reptiles were recorded in survey area 1 and very low numbers were recorded in survey area 4. An increase in the density of sheets in these areas is unlikely to have changed the recording of reptiles in these areas as sheets were placed in the most suitable habitats for reptiles, within each survey area.

4. Results

4.1 Desk Study

- 4.1.1 The data search returned 21 records of Common Lizard, two records of Slow Worm and 20 records of Grass Snake within 2 km of the Site and within the ten years of the request date. The closest Common Lizard record from the search was approximately 110 m east of the Site boundary in 2016. Both Slow Worm records were returned from outside of the Site, within Sutton Courtenay Environmental Education Centre in 2014 and 2015, approximately 370 m north of the Site boundary. The closest Grass Snake record was returned from within the Site boundary within the Didcot to Culham River Crossing area in 2016.

4.2 Habitat Suitability Assessment

- 4.2.1 Habitat within the Site consists of arable farmland, grassland and scrub connected by hedgerows. Most of the reptile survey areas across the Site are within grassland with good connectivity to more favourable habitat off-site. Therefore, these areas were graded as good with optimal – sub-optimal suitability for reptiles and subject to presence or absence surveys.

4.3 Reptile Presence / Absence

- 4.3.1 Two species of reptile, Common Lizard and Grass Snake were recorded in Areas 2 and 4 during field surveys in autumn 2020. The location of the reptiles recorded during the surveys are presented in Figure 3 (Appendix A).
- 4.3.2 No reptiles were recorded within the remaining areas. The date of survey, species, age class, number of individuals and location of reptiles found within the Scheme are detailed below in Table 4-1.

Table 4-1. Reptile species recorded within the Site

Date	Species	Age Class	Number of individuals	Survey area
09/09/2020	Common Lizard	Adult	1	4
	Grass Snake	Juvenile	1	4
10/09/2020	Common Lizard	Adult	1	2
11/09/2020	Grass Snake	Juvenile	1	2
	Grass Snake	Juvenile	1	4
17/09/2020	Common Lizard	Adult	1	4
21/09/2020	Grass Snake	Juvenile	2	4
25/09/2020	Common Lizard	Sub-adult	1	2

- 4.3.3 Whilst collecting the refugia mats on the 5th October 2020, two adult Common Lizards were observed within Area 2. The locations of both these findings are presented in Figure 3.

4.4 Additional Observation of Reptiles during Ecological Surveys

- 4.4.1 During a Great Crested Newt (*Triturus cristatus*) survey on 23rd April 2020, an adult Grass Snake was observed approximately 150 m west of the Site boundary and Area

5. Additionally, during a terrestrial invertebrate survey on 19th September 2020 an adult Grass Snake skin and an adult female Grass Snake were observed within the Site boundary, approximately 160 m north of Area 5. The locations of where these reptiles were found are presented in Figure 3.

5. Evaluation

- 5.1.1 Two species of reptile, Common Lizard and Grass Snake, were recorded within the Site during field surveys in 2020. Both species were recorded within Areas 2 and 4, with a higher number of individuals of both Common Lizard and Grass Snake recorded in Area 4.
- 5.1.2 No reptiles were recorded within Areas 1, 3, 5, 6, 7, 8, 9, 10 or 11; however, reptiles were recorded 150 m west and 160 m north of Area 5.
- 5.1.3 Records of Slow Worm were returned by the desk study, but these were recorded 370 m north of the Site boundary and so will not be impacted by the Scheme.

5.2 Population Size Assessment

- 5.2.1 The population size assessment of reptiles within the Site was measured using guidance in Table 3-3 of this report and was used to obtain a basic evaluation of the size and importance of the population of reptiles within the Site. When determining the population size of reptiles on a site, consideration must be made for other factors that may influence the assessment such as habitat quality and species ecology, whilst also acknowledging that estimating reptile population sizes can be difficult to achieve because each survey visit may only reveal a small sample of the population and the proportion of animals that may be detected during surveys will vary according to, for example, weather and migration patterns.
- 5.2.2 To allow for focussed estimation of the population size, relevant to the Site, only the maximum counts of Grass Snake and Common Lizard recorded on a single site visit have been used in the following assessment.

Grass Snake

- 5.2.3 Grass Snake is a transient species, hibernating during winter months and often travelling away from hibernation sites to lay eggs.

Area 2

- 5.2.4 The maximum count for Grass Snake within Area 2 was one individual, resulting in an average score, for Grass Snake across all survey visits, of 0.14 Grass Snake per survey.
- 5.2.5 Therefore, when evaluating a maximum count of one individual against the criteria in Table 3-3 of this report, the population of Grass Snake is classified as low and of no more than local importance.

Area 4

- 5.2.6 The maximum count for Grass Snake within Area 4 was two animals, resulting in an average score, for Grass Snake across all survey visits, of 0.29 Grass Snake per survey.
- 5.2.7 Therefore, when evaluating a maximum count of two animals against the criteria in Table 3-3 of this report, the population of Grass Snake is classified as low and of no more than local importance.

Common Lizard

Area 2

- 5.2.8 The maximum count for Common Lizard within Area 2 was one individual, resulting in an average score, for Common Lizard across all survey visits, of 0.14 Common Lizard per survey.
- 5.2.9 Therefore, when evaluating a maximum count of one individual against the criteria in Table 3-3 of this report, the population of Common Lizard is classified as low and of no more than local importance

Area 4

- 5.2.10 The maximum count for Common Lizard within Area 4 was one individual, resulting in an average score, for Common Lizard across all survey visits, of 0.14 Common Lizard per survey.
- 5.2.11 Therefore, when evaluating a maximum count of one individual against the criteria in Table 3-3 of this report, the population of Common Lizard is classified as low and of no more than local importance.

6. Conclusions and Recommendations

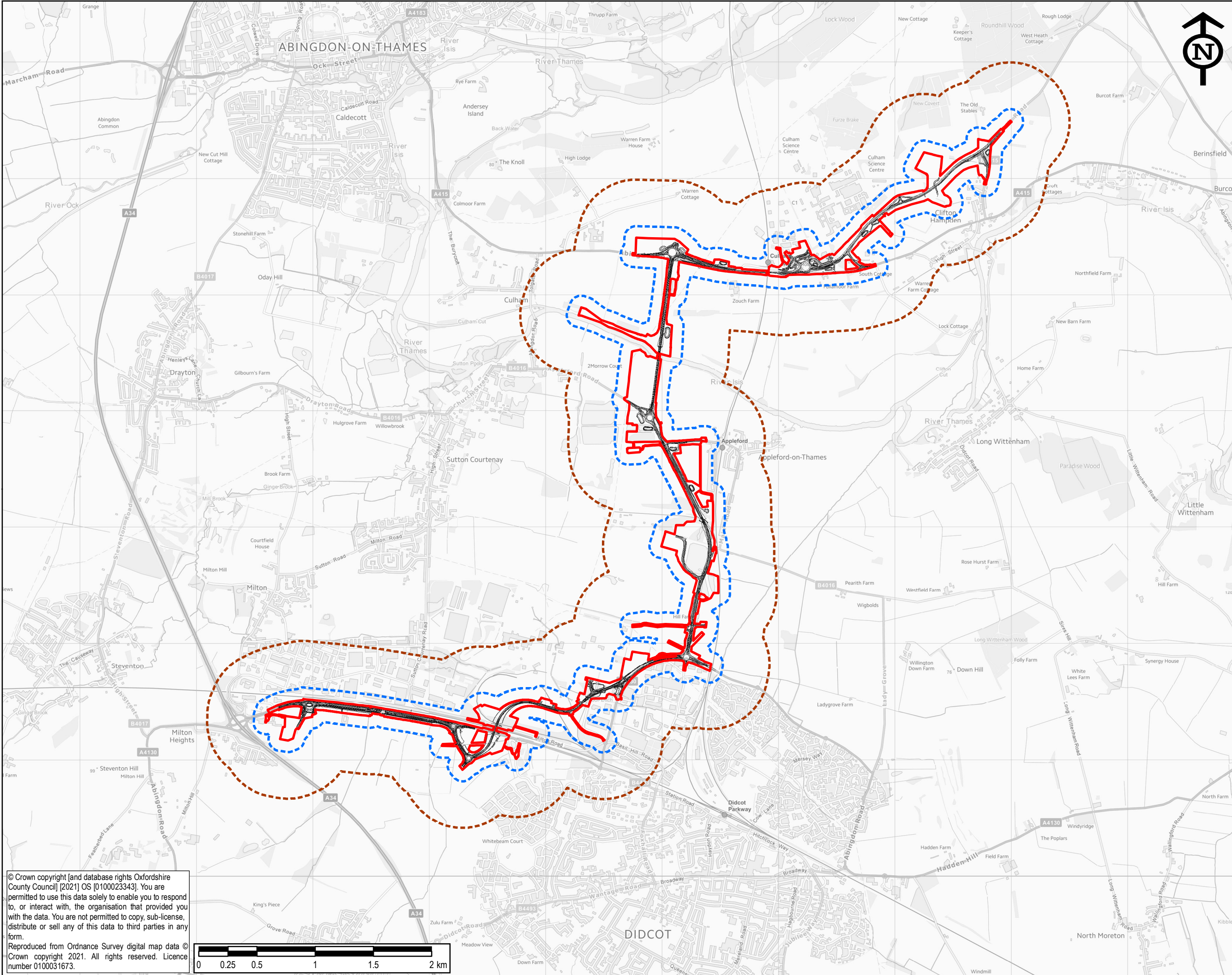
- 6.1.1 The reptile surveys undertaken in 2020 identified the presence of low numbers of two reptile species (Common Lizard and Grass Snake) within Areas 2 and 4. Area 2 is found within the A4130 Widening site and Area 4 is found within the Didcot to Culham River Crossing site. A further two adult Grass Snakes were found 150 m west and 160 m north to Area 5 within the Didcot to Culham River Crossing site.
- 6.1.2 For both Common Lizard and Grass Snake, a very low population (local importance) was observed within the Site in localised areas.
- 6.1.3 Any development within Areas 2, 4 and 5 has the potential to impact on reptile populations. In the absence of appropriate mitigation, these impacts will be:
- risk of incidental injury and mortality to Common Lizard and Grass Snake during the construction of the Scheme;
 - permanent loss of foraging habitat, used by two species of reptile; and
 - temporary disturbance of foraging reptiles, potentially using arable field margins, during construction of the Scheme.
- 6.1.4 Both Common Lizard and Grass Snake are listed under Schedule 5 of the Wildlife & Countryside Act 1981 (as amended), which prohibits intentional injuring or killing of a reptile. Therefore, through the implementation of a mitigation strategy, formalised through a Construction and Environment Management Plan (CEMP), the potential for killing and injuring of reptiles will be avoided. Mitigation is required to:
- ensure compliance with relevant legislation; and
 - avoid impacts that will give rise to a potential “significant effect”, therefore contrary to planning policy and biodiversity obligations of the NERC Act 2006.
- 6.1.5 A significant negative effect is one which undermines nature conservation objectives or changes the conservation status of a species population.

Appendix A Figures

Figure 1. Scheme Layout

Figure 2. Reptile Survey Areas

Figure 3. Reptile Survey Results



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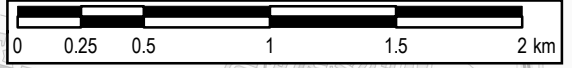
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- Indicative OCC Highway Design (Subject to Change)
- 100m Study Area
- 500m Study Area

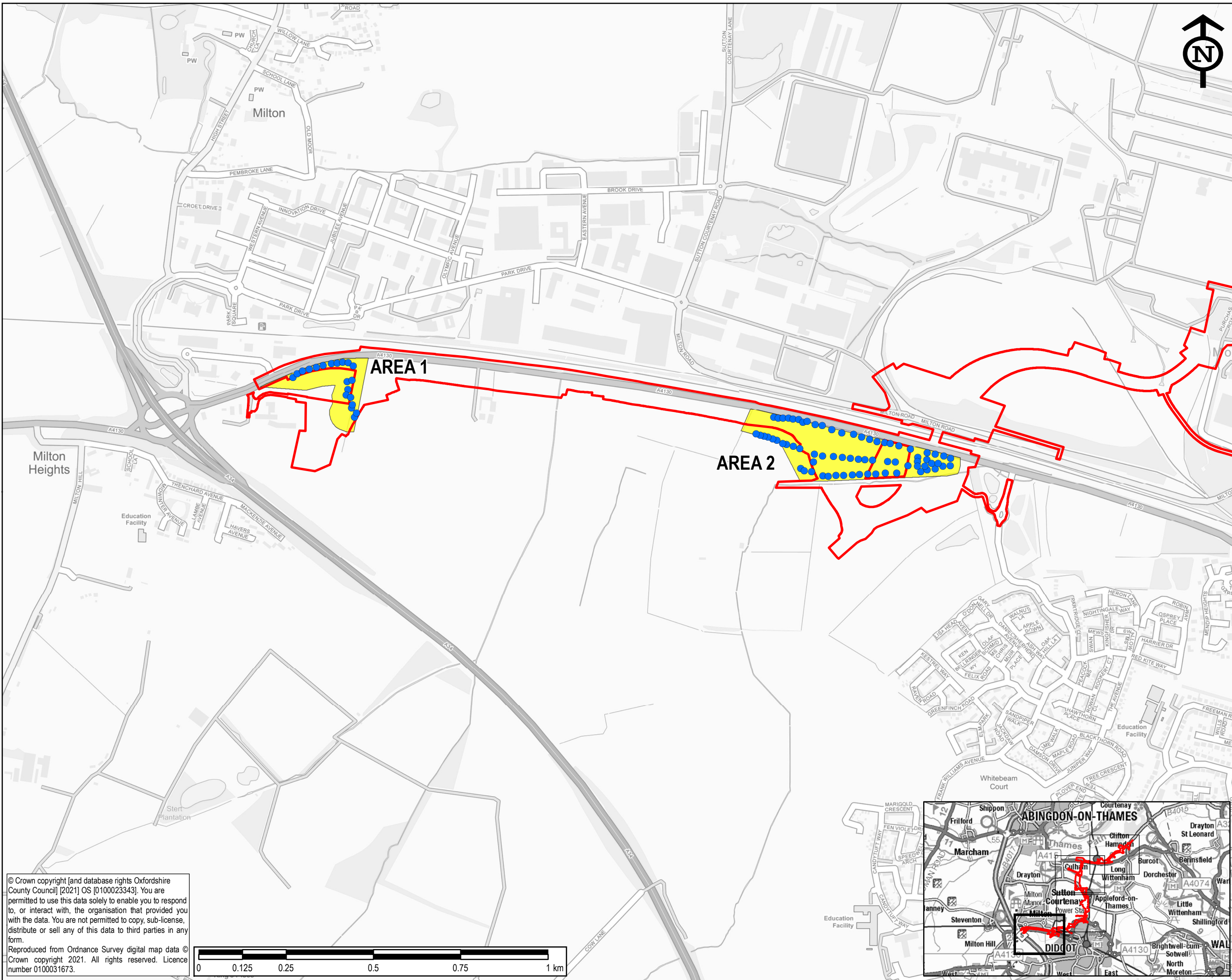
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DIDCOT GARDEN TOWN HIF 1 SCHEME				
Drawing Title				
FIGURE 1 SCHEME LOCATION				
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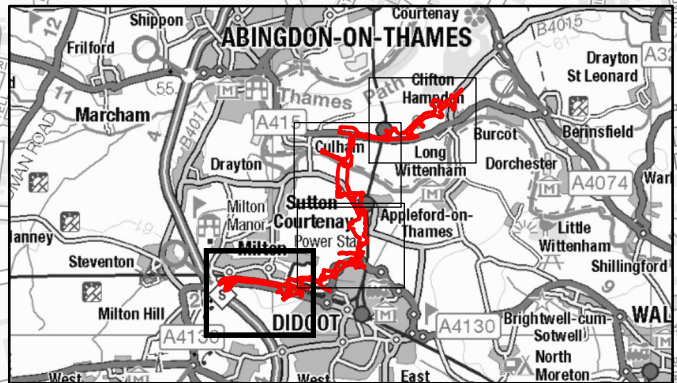
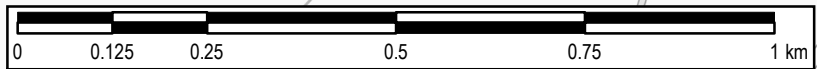
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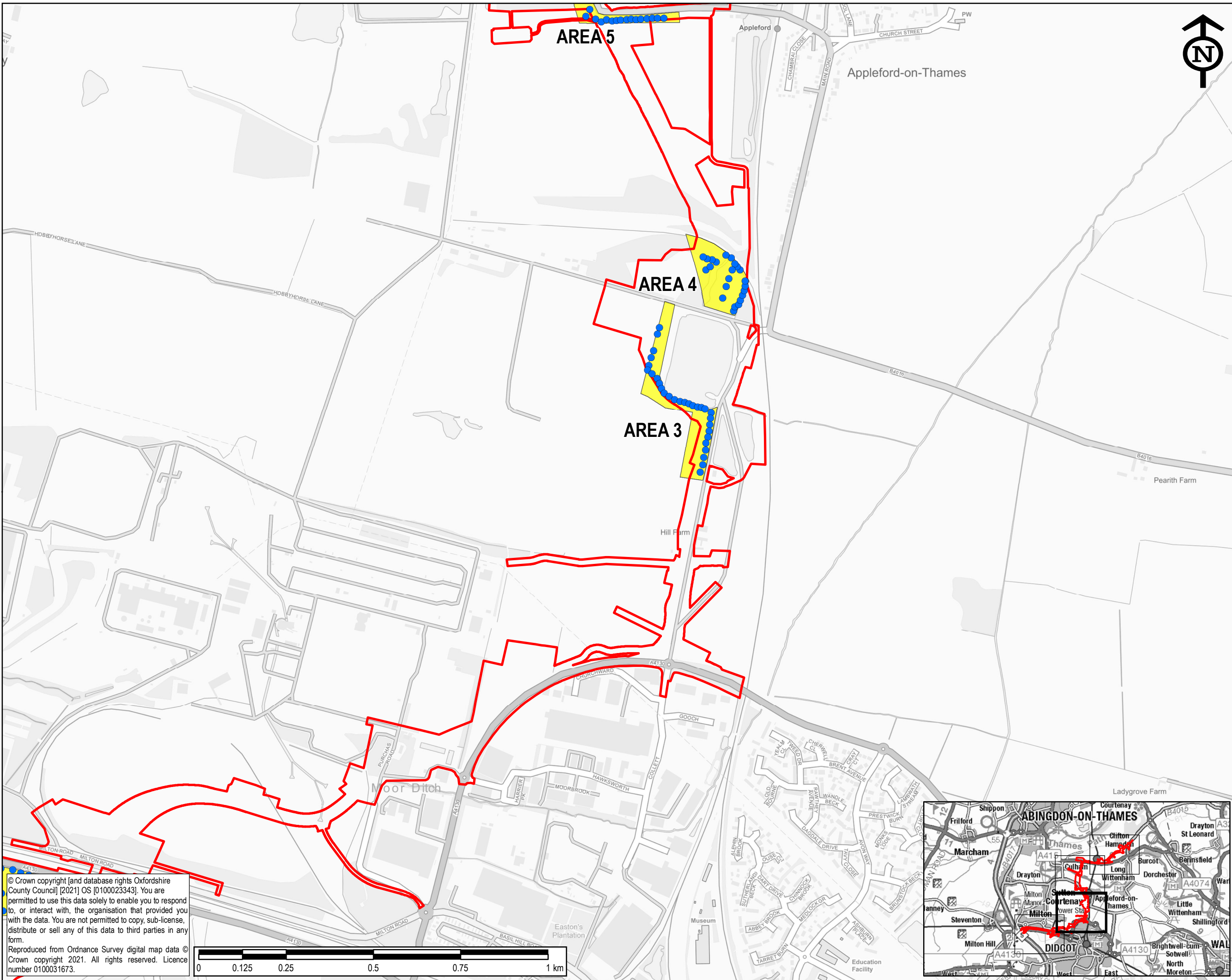
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- Reptile Survey Area
- Reptile Refugia Mat

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Purpose of Issue				
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Drawing Title				
FIGURE 2 REPTILE SURVEY AREAS SHEET 1 OF 4				
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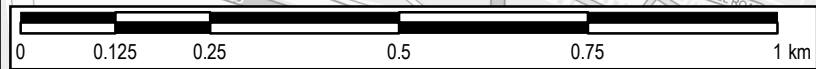
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Reptile Survey Area

Reptile Refugia Mat

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FIGURE 2
REPTILE SURVEY AREAS
SHEET 2 OF 4

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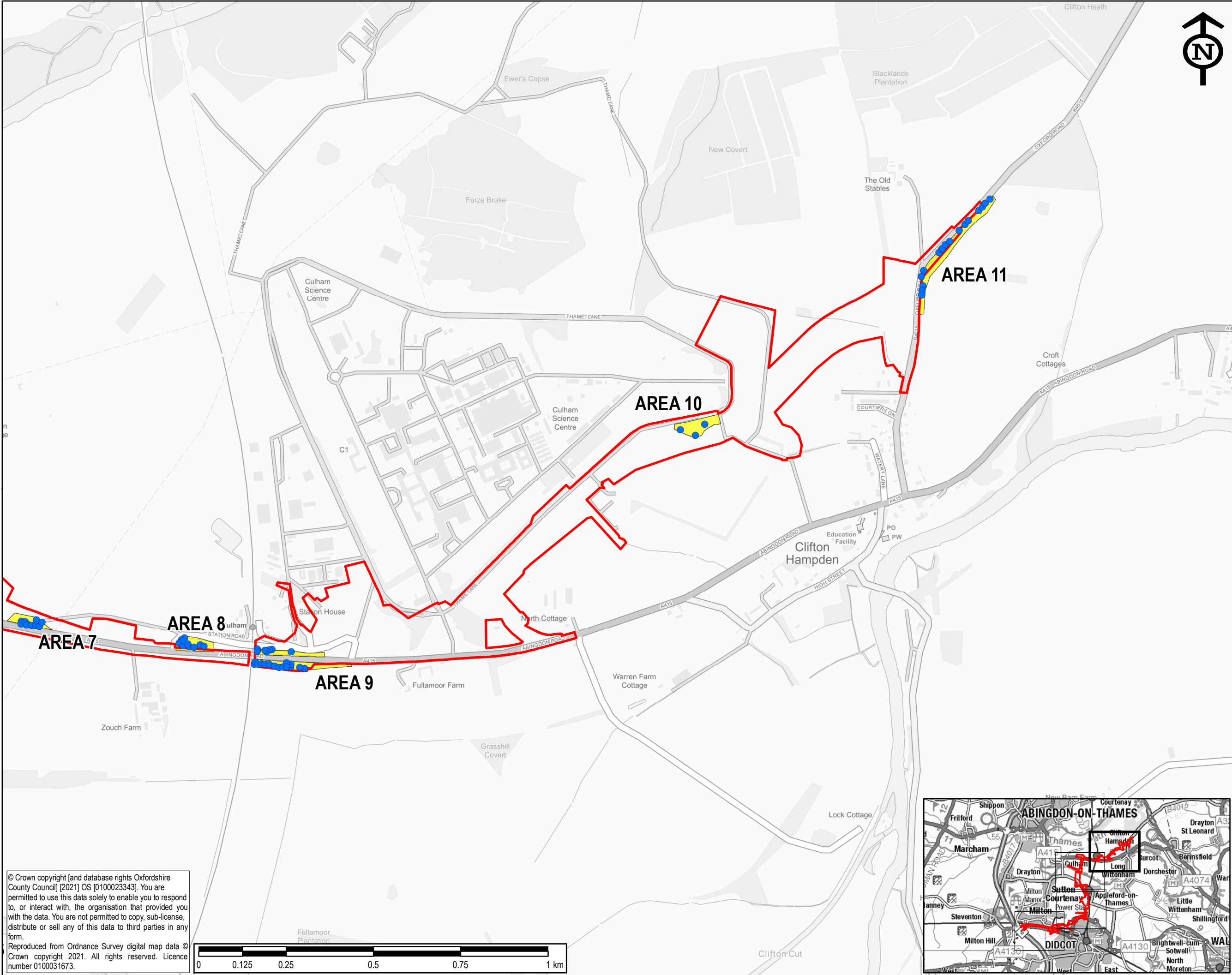
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- Indicative Red Line Boundary (Subject to Change)
- Reptile Survey Area
- Reptile Refugia Mat

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FIGURE 2
REPTILE SURVEY AREAS
SHEET 4 OF 4

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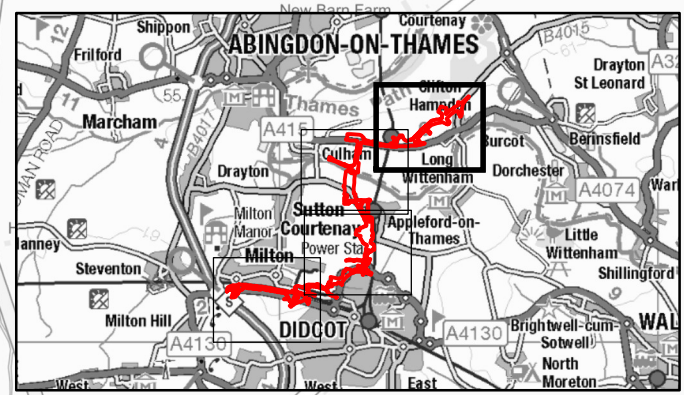
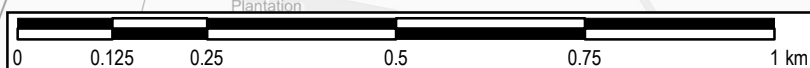
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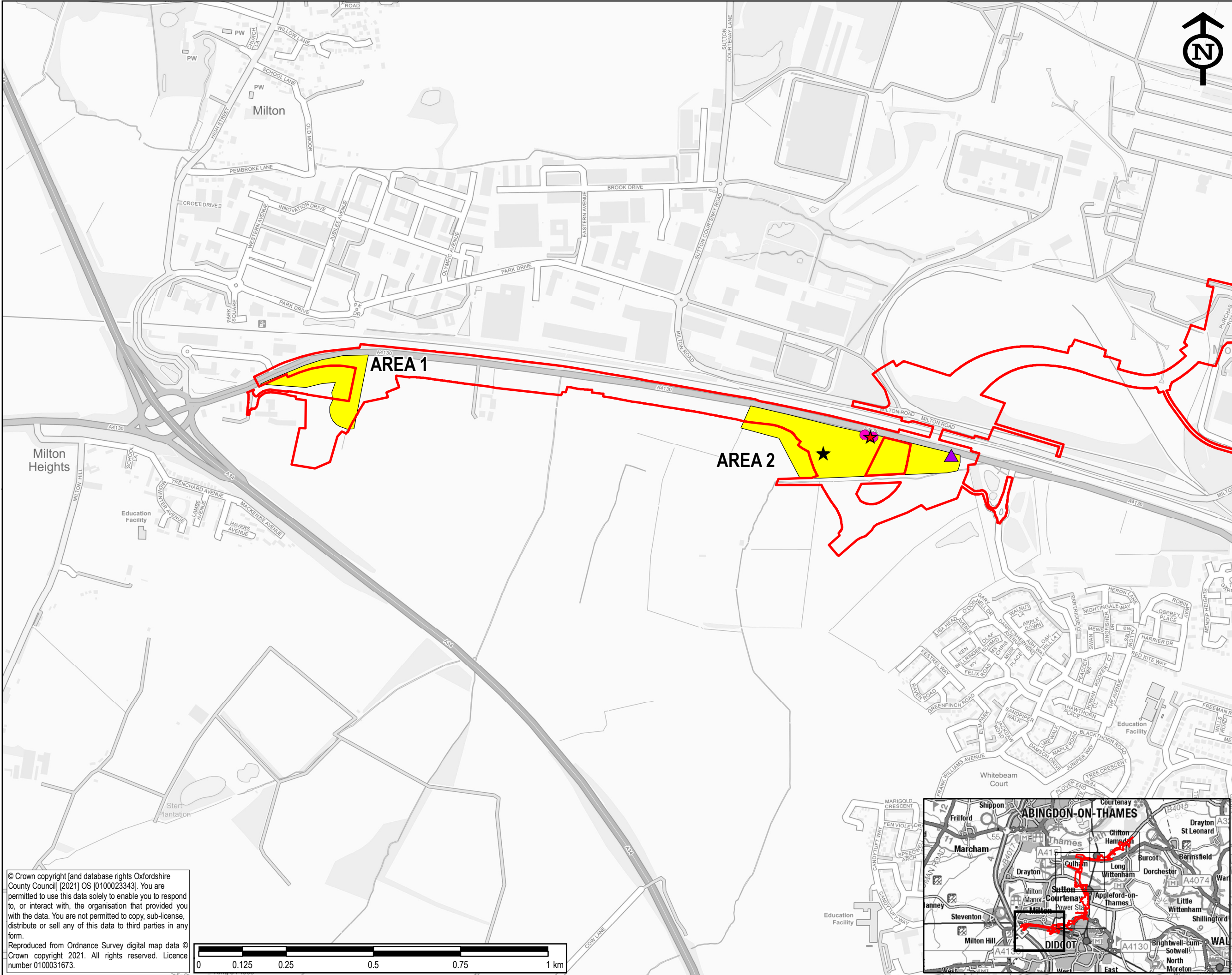
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Indicative Red Line Boundary (Subject to Change)

Reptile Survey Area

Reptiles Found:

Common Lizard

- ★ 09/09/2020
- ★ 10/09/2020
- ★ 17/09/2020
- ★ 25/09/2020

Grass Snake

- ▲ 09/09/2020
- ▲ 11/09/2020
- ▲ 30/09/2020

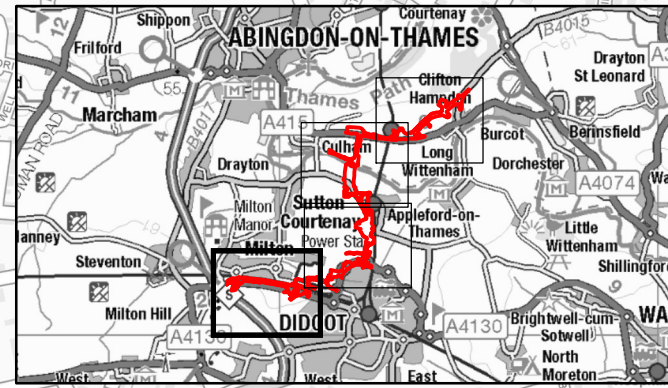
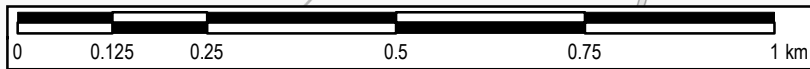
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- Adult grass snake
- Common Lizard

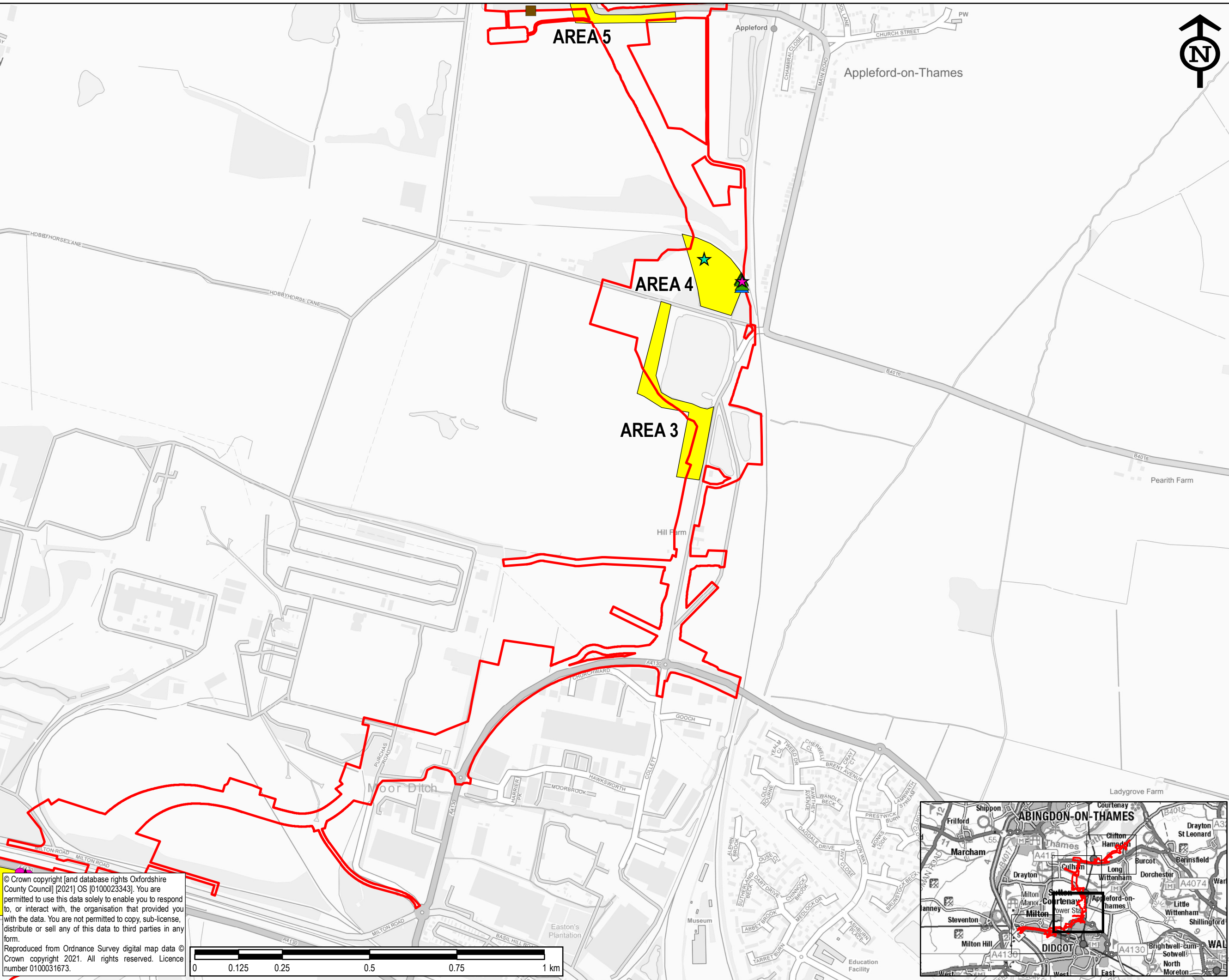
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Drawing Title	FIGURE 3 REPTILE SURVEY RESULTS SHEET 1 OF 4			
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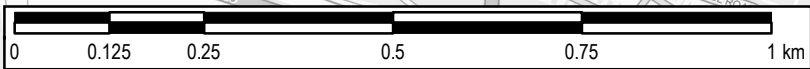
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Indicative Red Line Boundary (Subject to Change)

Reptile Survey Area

Reptiles Found:

Common Lizard

- ★ 09/09/2020
- ★ 10/09/2020
- ★ 17/09/2020
- ★ 25/09/2020

Grass Snake

- ▲ 09/09/2020
- ▲ 11/09/2020
- ▲ 30/09/2020

Additional Observations:

- Adult female grass snake skin
- Adult grass snake
- Common Lizard

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**OXFORDSHIRE
COUNTY COUNCIL**

Project Title

**DIDCOT GARDEN TOWN
HIF 1 SCHEME**

Drawing Title

**FIGURE 3
REPTILE SURVEY RESULTS
SHEET 2 OF 4**

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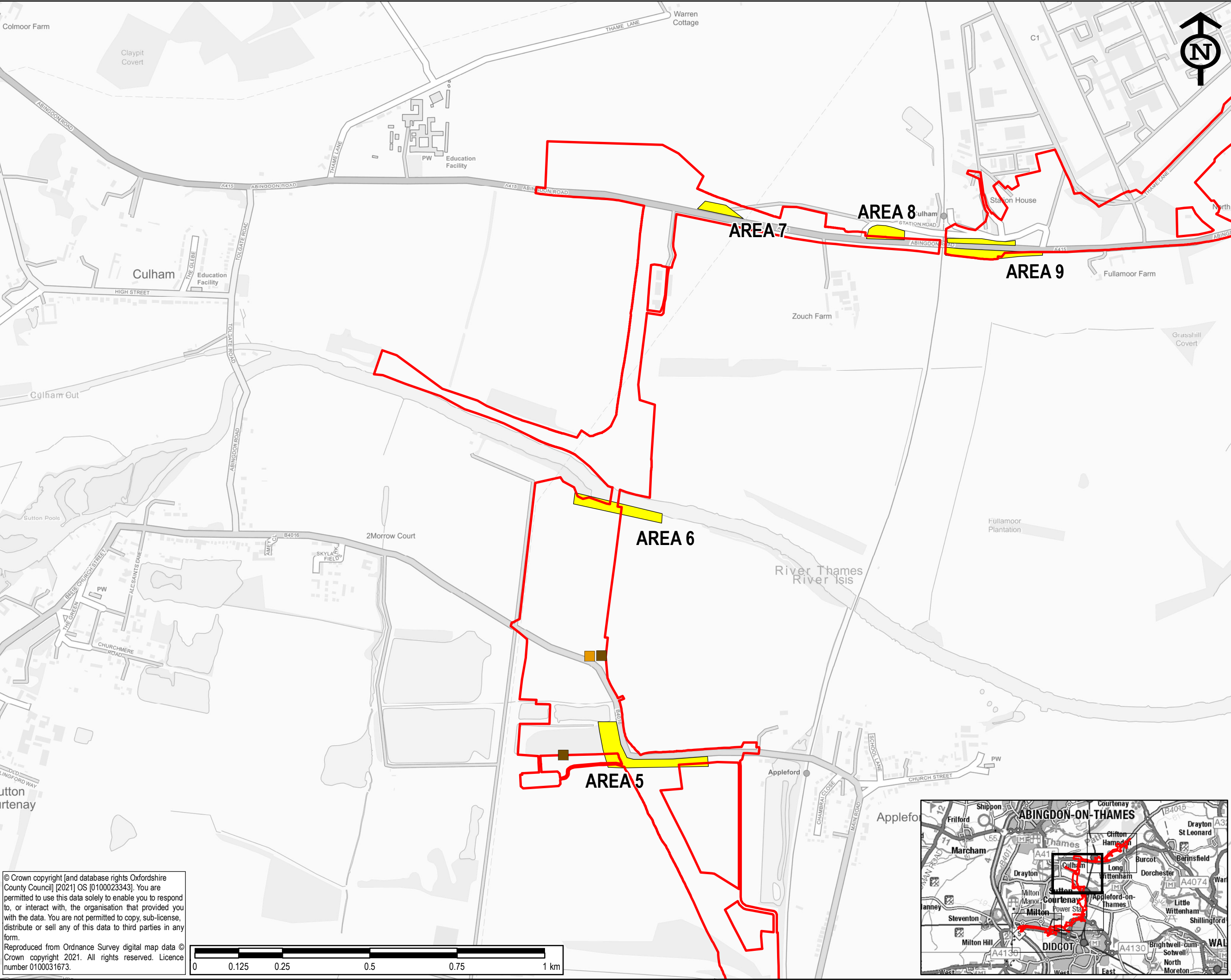
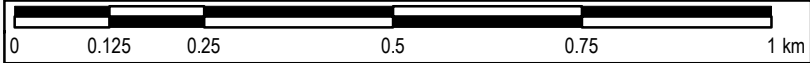
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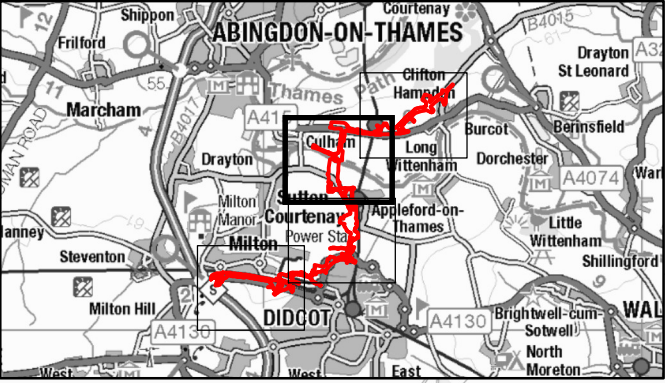
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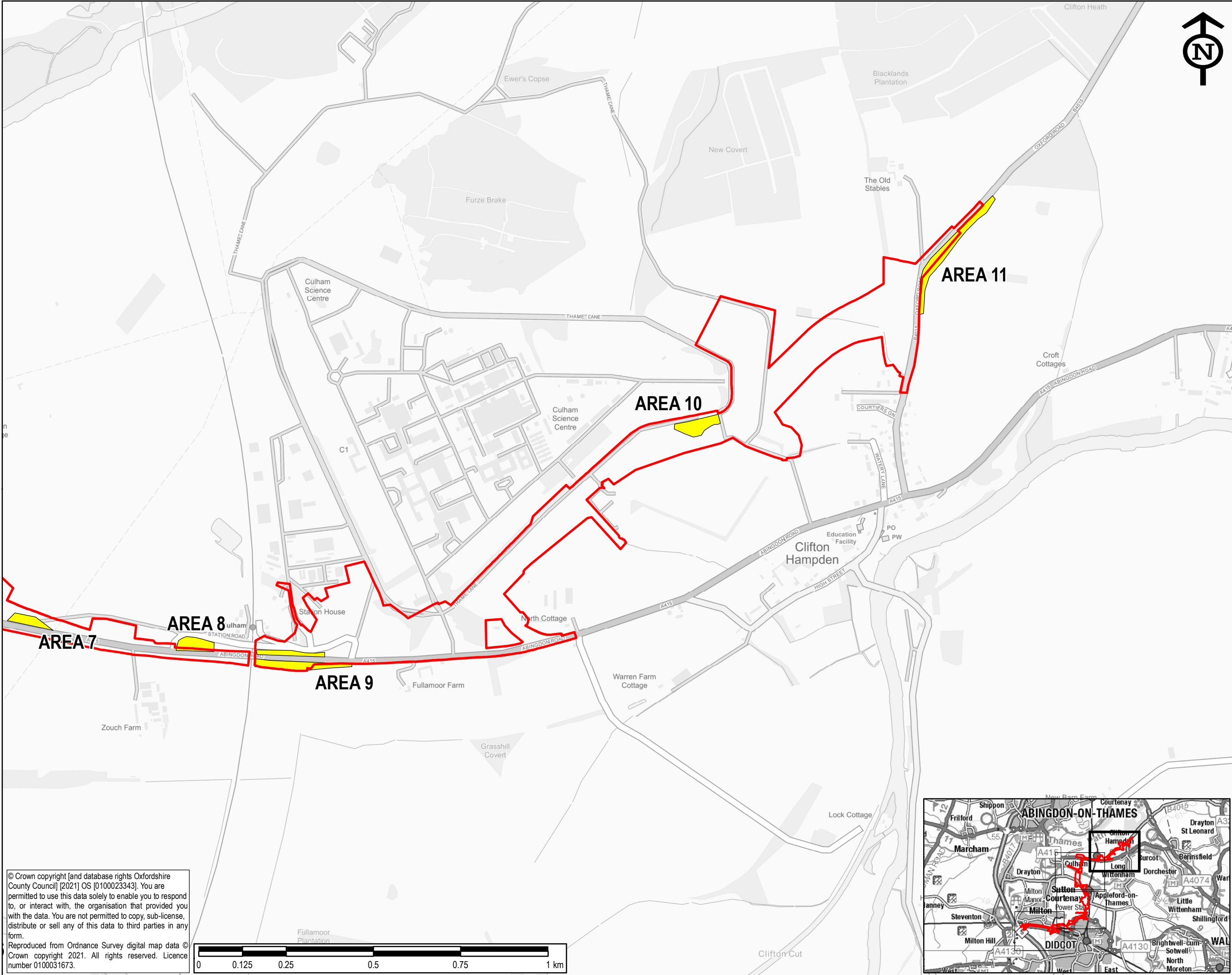
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- Indicative Red Line Boundary (Subject to Change)
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- Reptiles Found:**
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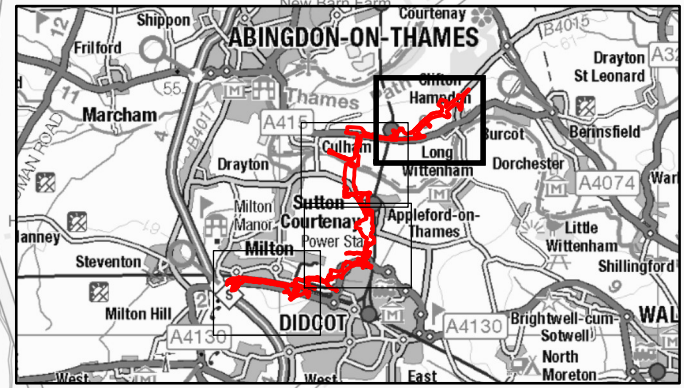
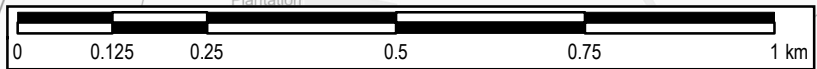
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SHEET 4 OF 4			
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Appendix B Survey Results

Table B.1. Survey dates, weather conditions and other notable species recorded during the reptile surveys carried out in 2020

Survey Visit	Survey Date	Area	Temp (°C)	Cloud Cover	Wind (Beaufort)	Other Notable Species
1	09/9/2020	1	16	7/8	1	-
		2	16	7/8	1	Common Toad (<i>Bufo bufo</i>)
		3	17	7/8	1	Smooth Newt (<i>Lissotriton vulgaris</i>)
		4	17	7/8	1	-
		5	17	7/8	1	Common Toad
		6	17	7/8	1	-
		7	19	7/8	1	-
		8	19	7/8	1	-
		9	19	7/8	1	
		10	19	7/8	1	
		11	19	7/8	1	
2	10/09/2020	1	17	2/8	1	
		2	17	2/8	1	Common Toad
		3	15	2/8	1	
		4	15	2/8	1	Common Toad, Smooth Newt
		5	15	2/8	1	Common Toad
		6	13	1/8	1	
		7	10	1/8	1	
		8	10	1/8	1	
		9	10	1/8	1	
		10	12	1/8	1	
		11	12	1/8	1	

Survey Visit	Survey Date	Area	Temp (°C)	Cloud Cover	Wind (Beaufort)	Other Notable Species
3	11/09/2020	1	11	2/8	2	
		2	11	2/8	2	Common Toad
		3	15	2/8	2	Common Toad
		4	15	2/8	2	
		5	15	2/8	2	
		6	16	4/8	2	
		7	17	6/8	3	
		8	17	6/8	3	
		9	17	6/8	3	
		10	17	6/8	3	
		11	17	6/8	3	
4	17/09/2020	1	18	0/8	3	
		2	17	0/8	3	
		3	17	0/8	3	
		4	17	0/8	3	Smooth Newt
		5	17	0/8	3	
		6	15	0/8	3	
		7	15	0/8	3	
		8	15	0/8	3	
		9	15	0/8	3	
		10	15	0/8	3	
		11	14	0/8	3	
5	18/09/2020	1	16	1/8	2	
		2	15	1/8	3	
	19/09/2020	3	16	2/8	3	
		4	16	2/8	3	
		5	18	2/8	3	
	18/09/2020	6	Refugia removed			

Survey Visit	Survey Date	Area	Temp (°C)	Cloud Cover	Wind (Beaufort)	Other Notable Species
		7	16	1	3	
		8	16	1	3	
		9	18	1	2	
		10	18	1	2	
		11	19	1	3	
6	21/09/2020	1	13	8/8	1	
		2	13	8/8	1	Common Toad
		3	17	1/8	1	Common Toad
		4	17	1/8	1	Smooth Newt
		5	18	0/8	1	Common Toad
		6	Refugia removed			
		7	15	7/8	1	
		8	15	7/8	1	
		9	15	7/8	1	
		10	16	7/8	1	
		11	16	7/8	1	
7	25/09/2020	1	13	6/8	5	
		2	13	6/8	5	
		3	12	1/8	4	Smooth Newt
		4	12	1/8	4	
		5	12	1/8	4	
		6	Refugia removed			
		7	10	2/8	4	
		8	10	2/8	4	
		9	10	2/8	4	
		10	9	1/8	3	
		11	9	1/8	3	

Notes on Table B.1: Wind speed is shown using the Beaufort scale, which is an empirical measure of force (F) 0-12 that relates wind speed to observed conditions. Cloud cover is shown in a scale of 0-8 where the number represents the amount of cloud cover *e.g.* 2/8 is 25% cover 4/8 is 50% etc.

Annex 7 – Appendix 9.6: Great Crested Newt Survey Report



REVISED

Didcot Garden Town HIF 1 Scheme

Environmental Statement

Volume III

Appendix 9.6: Great Crested Newt Survey Report

October 2022

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Executive Summary

A review of Ordnance Survey (OS) mapping of the Scheme, as part of the desk study for the Preliminary Ecological Appraisal (PEA) (undertaken by AECOM in January 2020 (AECOM, 2020¹)) identified that the habitat within the Scheme boundary (the Site) was suitable to support Great Crested Newt. Surveys were, therefore, required to determine the presence or absence of Great Crested Newt within the Site and an appropriate survey buffer of 500 m from the Site (referred to hereafter as the survey area).

The Scheme comprises the following four improvement sites (see Figure 1):

- A4130 Widening, which will dual the existing road between Milton Gate and the new Didcot Science Bridge, with several new junctions into adjacent proposed developments;
- Didcot Science Bridge, a new bridge over the Great Western Railway Mainline and a new link road through the former Didcot A Power Station site, re-joining the A4130 Northern Perimeter Road north of the Purchas Road/Hawksworth roundabout;
- Didcot to Culham River Crossing, providing a new road connecting the A4130 at Didcot with the A415 at Culham, including a bridge over the River Thames and another bridge over a private rail line, and connections to Appleford and Sutton Courtney via B4016;
- Clifton Hampden Bypass, a new relief road north of the village, between the A415 at Culham Science Centre and the B4015 Oxford Road, north of Clifton Hampden.

The objective of the Great Crested Newt survey was to identify the presence or absence of this species within the survey area and which will assist in determining whether the Scheme has the potential to impacts Great Crested Newt.

Of the 51 waterbodies and watercourses identified within the survey area, 32 were taken forward for further assessments, with the remaining 19 waterbodies and watercourses scoped out.

Great Crested Newt surveys using traditional methods were conducted between April and May 2020.

No Great Crested Newt were recorded in any of the surveyed waterbodies and watercourses.

Five Great Crested Newt were recorded within the Sutton Courtenay Environmental Education Centre (BBOWT Site), which is approximately 360 m from the Site.

Connectivity between the Scheme and Sutton Courtenay Environmental Education Centre is limited with dry ditches (such as WB19) and other waterbodies and watercourses that are unsuitable for Great Crested Newt.

Given that there are significant barriers to dispersal and no hydrological connections to waterbodies or watercourses outside of the reserve boundary, it is highly unlikely that Great Crested Newt is present within the Scheme boundary and this is further substantiated by the results of the surveys as reported herein. However, a precautionary method of working will be adopted during construction of the Scheme within 500 m of the Sutton Courtenay Environmental Education Centre – refer to Section 6.3.

Habitat enhancement and creation measures will be proposed as part of the ecological mitigation and enhancement strategy and subsequently contribute to biodiversity net gain.

1. Introduction

1.1 Background

- 1.1.1 AECOM was commissioned by Oxfordshire County Council (the client) to undertake a programme of Great Crested Newt (*Triturus cristatus*) surveys along the proposed Didcot Garden Town HIF1 Scheme (hereafter referred to as the ‘Scheme’).
- 1.1.2 A review of Ordnance Survey (OS) mapping of the Scheme, as part of the desk study for the Preliminary Ecological Appraisal (PEA) (undertaken by AECOM in January 2020 (AECOM, 2020¹)) identified that the habitat within the Scheme boundary (the Site) was suitable to support Great Crested Newt. Surveys were, therefore, required to determine the presence or absence of Great Crested Newt within the Site and an appropriate survey buffer of 500 m from the Site (referred to hereafter as the survey area).
- 1.1.3 The information described in this report provides a Great Crested Newt baseline which will be used to inform the Environmental Impact Assessment (EIA) for the Scheme.

1.2 The Scheme

- 1.2.1 The Scheme is located to the west and north of Didcot, Oxfordshire, between the Milton Interchange Service Area in the west (at OS grid reference SU483913) and the B4015 north-east of the village of Clifton Hampden (at OS grid reference SU548962).
- 1.2.2 The Scheme comprises the following four improvement sites (see Figure 1):
- A4130 Widening, which will dual the existing road between Milton Gate and the new Didcot Science Bridge, with several new junctions into adjacent proposed developments;
 - Didcot Science Bridge, a new bridge over the Great Western Railway Mainline and a new link road through the former Didcot A Power Station site, re-joining the A4130 Northern Perimeter Road north of the Purchas Road/Hawksworth roundabout;
 - Didcot to Culham River Crossing, providing a new road connecting the A4130 at Didcot with the A415 at Culham, including a bridge over the River Thames and another bridge over a private rail line, and connections to Appleford and Sutton Courtney via B4016;
 - Clifton Hampden Bypass, a new relief road north of the village, between the A415 at Culham Science Centre and the B4015 Oxford Road, north of Clifton Hampden.
- 1.2.3 The central grid reference for the Scheme is SU 521 923.

1.3 Site Descriptions

- 1.3.1 The land use within the Site is a mixture of agricultural land, with an active power station site, an old power station site (Didcot A Power Station) currently undergoing redevelopment, an industrial estate, a live landfill site and a quarry. Multiple waterbodies are also present within the Site and the survey area.

- 1.3.2 A summary description of the four Scheme component sites is provided below, whilst a detailed description of the habitats present within the Site is provided in the Didcot Garden Town: Preliminary Ecological Appraisal report (AECOM, 2020¹). The Scheme layout is shown in Figure 1.

A4130 Widening

- 1.3.3 This part of the Scheme comprises a dual-carriageway from a point approximately 250 m east of Milton Interchange at the junction with Milton Gate, eastwards for approximately 1.6 km to the proposed eastern roundabouts connecting into the future development at Valley Park and the Didcot Science Bridge scheme. Dualling of the A4130 will consist of modifications to the existing single carriageway, establishment of a central reserve and provision of two additional lanes to the south. The existing single carriageway will form the eastbound carriageway towards Didcot and the newly constructed lanes will form the westbound carriageway to the A34 Milton Interchange.
- 1.3.4 A four-arm roundabout at the western end of the scheme is proposed to serve an area located immediately south-west of this roundabout, which has been subject to approved outline development proposals for Roadside Services and Facilities (planning application reference P15/V2880/O). This Backhill roundabout will also provide access to the North West of Valley Park strategic housing allocation site, to the south and east.
- 1.3.5 A new signalised T-junction is proposed approximately 600 m east of the Backhill roundabout which will provide access to the Valley Park strategic housing allocation site, which is the subject of an outline planning application P14/V2873/O, with a resolution to grant permission subject to Section 106 agreement.
- 1.3.6 A new three-arm 'Old A4130' roundabout is proposed 600 m east of the signalised junction. The eastern arm will be the current A4130, that is to be retained as a single carriageway, providing access into Didcot. The south-eastern arm is proposed to be an approximately 260 m single carriageway road connecting to the new Didcot Science Bridge three-arm roundabout. The Didcot Science Bridge roundabout will provide access to the new Didcot Science Bridge to the north, and Valley Park housing development to the south. Access at this location is already being secured through the outline planning application for Valley Park.
- 1.3.7 The road corridor will also include a bi-directional segregated cycleway and a footway on the southern side of the dual carriageway, as well as several formal crossing points and buffer.

Didcot Science Bridge

- 1.3.8 This section of the proposed scheme is a new north-south bridge from the proposed Didcot Science Bridge roundabout, over the existing A4130, the Great Western Railway Mainline, and Milton Road, into the former Didcot A Power Station site. The proposed Science Bridge Link Road (SBLR) will connect the bridge with the A4130 Northern Perimeter Road north of the Purchas Road/Hawksworth roundabout, close to the existing Southmead Industrial Estate.
- 1.3.9 Planning permission (P15/S1880/O and P15/V1304/O) has been granted for a mixed-use development in the power station site and this includes the reservation of land for the SBLR and Didcot Science Bridge. There will be various embankments associated with the road bridge approaches, and they will vary in width. The road

¹ AECOM (2020). Didcot Garden Town Preliminary Ecological Appraisal.

bridge will be approximately 16 m in width, including a single carriageway, a bi-directional segregated cycleway and a footway on one side of the road.

- 1.3.10 The SBLR will be a single carriageway, with segregated footways and bi-directional cycleways on both sides of the road for the majority of its length. Various accesses are planned off the road alignment for the proposed development in the power station site (P15/S1880/O and P15/V1304/O). Other works required include the diversion of a watercourse which will cross underneath the new road in a culvert, and provision of formal Non-Motorised User (NMU) crossings, including a toucan crossing where a National Cycle Route crosses the road alignment.

Didcot to Culham River Crossing

- 1.3.11 This section of the Scheme will provide a new 3.6 km single carriageway link road west of the Cherwell Valley railway line and NMU facilities between Didcot and Culham. It will extend north from the A4130 Collett roundabout in Didcot to the A415 Abingdon Road west of Culham Science Centre.
- 1.3.12 An improved and enlarged four-arm A4130 Collett roundabout will be provided. This will connect with the Didcot Science Bridge scheme to the west, the Didcot to Culham Link Road to the north, Southmead Industrial Estate to the south and to the existing A4130 to the east.
- 1.3.13 Agricultural land, private residential properties, a pallet and wood recycling centre, Sutton Courtenay landfill, and Hanson aggregate operations all lay north of Collett roundabout. A Local Development Order is being prepared to enable this agricultural area to become an employment site called D-Tech, in this “Didcot Growth Accelerator” Enterprise Zone.
- 1.3.14 North of Collett roundabout to the southern edge of Sutton Courtenay Landfill the new single carriageway road will be approximately 20 m wide with verges, hard strips, and segregated footways and bi-directional cycleways on both sides. Two accesses, one on either side of the proposed road, will be provided to maintain access to the adjacent agricultural land, private residential properties and businesses.
- 1.3.15 The road will extend north along the east edge of Sutton Courtenay Landfill. In this area on the west side of the road a 3.0 m shared use bridleway is provided with the segregated footways and bi-directional cycleways continuing on the east side. On the west side of the road a new priority junction and access road will be provided to Sutton Courtenay Landfill (operated by FCC Environment), and Hanson Aggregates and Appleford Railway Sidings (operated by Hanson). This will replace the existing Portway Road access further north.
- 1.3.16 The road extends north to Appleford railway sidings passing along the eastern boundary of a large surface water management pond. The Cherwell Valley Line and Appleford Level Crossing is located to the east of the proposed road. Appleford Sidings bridge will be provided to bridge the road over the railway sidings and connect the north and south approach embankments.
- 1.3.17 The road will traverse 90 Acre Field, an area of restored historic landfill, and link to the B4016 to the west of Appleford. A priority T-junction with a ghost island right turn lane will be provided at this location. Sutton Courtenay roundabout will be provided to the north-west with a severed section of the B4016 retained to be a footway cycleway. Sutton Courtenay roundabout will be an at grade, three-arm roundabout providing access to the crossing over the River Thames whilst maintaining links between Appleford, Sutton Courtenay and the surrounding areas.

- 1.3.18 Extending north from Sutton Courtenay roundabout, a 336-metre approach viaduct will be provided to cross the River Thames flood plain with a 155 m bridge provided to span over the River Thames. The River Thames is navigable at this location the bridge height has been designed to accommodate river traffic.
- 1.3.19 North of the River Thames, the new link road will continue north through existing agricultural land towards A415 where a new at grade four-arm roundabout will be constructed to connect with the A415 and a new development to the north which is an allocated site in the Local Plan.

Clifton Hampden Bypass

- 1.3.20 The Clifton Hampden Bypass will re-route traffic on the A415 around the village of Clifton Hampden, which currently experiences a large amount of through traffic as people travel between the A415 to A4074 northwest of the village.
- 1.3.21 The link road will provide a bypass northwest of Clifton Hampden village and will be approximately 2.2 km long. The new road will be a single carriageway with adjacent hard strips, grass verges, and a shared-use cycleway / footway. The bypass will be aligned in a south-west to north-east direction and will be a single carriageway, approximately 9.3 m in width including hard strips.
- 1.3.22 The proposed works also include the construction of a large four-arm roundabout at the western end of the Scheme, providing access to the SODC Local Plan allocated housing site, a railway station and Leda Properties owned farmland / businesses north of Culham Science Centre (CSC) coming off the northern arm, and CSC on the northeast arm. A new T- junction with a ghost island right turn lane connecting the existing B4015 Oxford Road is proposed at the eastern extent of the Scheme.
- 1.3.23 The current alignment of the A415 will be realigned north into the proposed bypass, with the existing A415 west of this point as a “no through road” to serve existing residences. All roundabout exits will include one lane, except the eastern bypass arm which will have two lanes. The roundabout will have a segregated left turn lane from the eastern bypass arm to the western A415 arm.
- 1.3.24 Station Road will be realigned and will join with a new entrance to the industrial properties located northwest of the roundabout. The existing main access into the CSC will be converted into a shared use footway / cycleway. The northeast roundabout arm will provide access to CSC via the main gate, and a stub towards Perimeter Road for a potential future connection to be delivered by CSC.
- 1.3.25 The A415 connection road east of the roundabout will provide access from the bypass to the existing A415 and Clifton Hampden.
- 1.3.26 Along the bypass, four access points will be included on the south side of the road; one will link to the existing alignment of the A415 (as described); one to a Thames Water sewage treatment works; and one to an existing farm track. The bypass will tie-in with the current alignment of the B4015 Oxford Road (east) and a T-junction with a ghost island right turn will be included, to provide access to the current alignment of the B4015 Oxford Road (south-west).
- 1.3.27 On the north side of the road, two accesses will be created; one will be a new second access into the CSC, the other will link with an existing farm track.

1.4 Survey Area

- 1.4.1 The survey area included all waterbodies (ponds and other accumulations of water) and watercourses (e.g. ditches) within 500 m of the Scheme boundary, as shown in Figures 2a and 2b.

1.5 Scope of the Report

- 1.5.1 The objective of the Great Crested Newt survey was to identify the presence or likely absence of this species within the survey area, which will assist in determining whether the Scheme has the potential to impacts Great Crested Newt.
- 1.5.2 This report includes the following information:
- Relevant legislation and policy;
 - Methods for desk- and field-based assessments (undertaken in 2019 and 2020);
 - Limitations to the surveys undertaken and any assumptions made as a result of incomplete data;
 - Survey results;
 - The approach for determining the nature conservation importance of Great Crested Newt populations recorded during the assessments; and
 - Conclusions and recommendations

2. Great Crested Newt Ecology

2.1 Overview

- 2.1.1 Great Crested Newt is one of seven species of amphibian considered native to Britain and similar to other UK amphibians, they spend the majority of their lives on land, returning to standing water (water bodies and ditches) in the spring in order to breed.

2.2 Temperature Effects on Great Crested Newt Activity

- 2.2.1 Great Crested Newts are ectothermic, meaning that they regulate their temperature through exchange of heat with the external environment. Gaseous exchange (oxygen/carbon dioxide) is achieved largely by absorption through their permeable skins, which must be moist for this purpose. Behaviour and activity are therefore strongly linked to external environmental conditions, especially daily and seasonal cycles. Great Crested Newts are mainly active at night (usually when temperatures exceed 5° Celsius (C) and following recent rainfall). With the onset of winter frosts, Great Crested Newts hibernate. Activity recommences when the frosts subside (which may be as early as January/February), with adults migrating to breeding water bodies. Peak breeding activity is usually between mid-March and mid-May.

2.3 Reproduction

- 2.3.1 Breeding takes place within water bodies with males performing a courtship ‘dance’ in order to attract and encourage females to take up a spermatophore (a packet containing sperm). Females deposit eggs (up to 200 per season) on the submerged leaves of aquatic broadleaved plants. Each egg is individually sealed for protection from predators within a folded leaf. Adults begin to leave the water bodies around May but may return in order to feed.
- 2.3.2 Larvae hatch after three weeks and feed on small aquatic invertebrates and the larvae/eggs of other amphibians for approximately three months. They metamorphose into land-adapted juveniles called eft and begin to emerge from their water bodies around August.

2.4 Habitat Requirements

- 2.4.1 During their terrestrial phase, Great Crested Newts require a complex habitat structure in order to provide both food and shelter. These are most commonly provided by broadleaved woodland, rough/tussocky grassland and scrub habitats. They also require a secure area in which to hibernate. Hibernacula generally need to provide a stable temperature, be free from frost and provide protection from flooding and predation. These requirements are commonly met by log/rubble piles, underground crevices or mammal burrows.
- 2.4.2 For breeding, Great Crested Newts require waterbodies that provide suitable protection and food for their developing larvae. Generally, such waterbodies should be of relatively good water quality so as to provide a diverse range of invertebrate prey. Unshaded water bodies tend to provide more of the required broadleaf aquatic vegetation, upon which Great Crested Newt eggs can be laid. Waterbodies with large fish populations (which can prey on newts) or heavy grazing pressure from waterfowl (which can prey on newts and reduce water quality and egg laying habitat) tend not to support Great Crested Newt. Connectivity between waterbodies and good quality terrestrial habitat tend to favour large, viable, populations of Great Crested Newt. In

rural landscapes in Britain, such connectivity is often provided by the hedgerow network.

2.5 Range

- 2.5.1 Great Crested Newts are thought to commonly move between waterbodies within 250 m of each other, although there are studies showing Great Crested Newt travelling much further than this (Great Crested Newt Mitigation Guidelines, English Nature 2001). The range of Great Crested Newt may be impacted by a range of factors, including the type and quality of habitat surrounding a breeding water body, the availability of hibernation sites and the presence or absence of barriers to dispersal (e.g. large and busy roads with no features that Great Crested Newt can move through).

3. Legislative and Policy Framework

3.1 Relevant Legislative Context

3.1.1 All stages of the Great Crested Newt life cycle as well as their habitat are fully protected under Schedule 2 of The Conservation of Habitats and Species Regulations 2017 (as amended). Great Crested Newt is listed on Schedule 5 of the Wildlife & Countryside Act 1981, which affords them protection under Section 9, as amended by the Countryside Rights of Way Act (2000). They are also listed on Annex II and VI of the EC Habitats Directive, are included as Species of Principal Importance in England under Section 41 of the Natural Environment and Rural Communities (NERC) Act 2006 and are UK Biodiversity Action Plan Species. In combination, this makes it an offence to:

- deliberately capture, injure or kill a Great Crested Newt;
- deliberately take or destroy their eggs;
- deliberately, intentionally or recklessly disturb an individual; or
- damage, destroy or obstruct access to any structure which a Great Crested Newt uses for shelter or protection.

3.1.2 The protection includes both the breeding waterbody itself and the terrestrial habitat used for foraging and hibernation, which may be distant from the waterbody.

3.2 European Protected Species Licensing

3.2.1 Where Great Crested Newt habitat, including their breeding sites and resting places, is present on a site and a development has the potential to cause one or more offences under the Conservation of Habitats and Species Regulations 2017 (as amended), a European Protected Species Licence (EPSL) is required from Natural England to allow the development to proceed. This licence allows the development to proceed with exemption from offences, provided works are undertaken with strict accordance of the terms of the licence. A licence cannot, however, be obtained to provide protection against offences under the Wildlife and Countryside Act, 1981 (as amended).

3.2.2 In determining whether to grant a licence, Natural England must apply the requirements of Regulation 535 of the Regulations, these being:

- Regulation 53(2)(e) states: “a licence can be granted for the purposes of “preserving public health or public safety or other imperative reasons of overriding public interest including those of a social or economic nature and beneficial consequences of primary importance for the environment”.
- Regulation 53(9)(a) states: “the appropriate authority shall not grant a licence unless they are satisfied “that there is no satisfactory alternative”.
- Regulation 53(9)(b) states: “the appropriate authority shall not grant a licence unless they are satisfied “that the action authorised will not be detrimental to the maintenance of the population of the species concerned at a favourable conservation status in their natural range.”

3.2.3 A local planning authority must also apply these tests when determining a planning application, where a proposed development is likely to cause an offence under the Conservation of Habitats and Species Regulations 2017 (as amended).

- 3.2.4 In order for an EPSL to be approved by Natural England for works with Great Crested Newt, it must be demonstrated that the proposed development will minimise any potential impacts upon Great Crested Newt and will not be detrimental to the maintenance of the population of the species concerned at a favourable conservation status in their natural range.
- 3.2.5 Offences can be avoided through the implementation of appropriate mitigation that will minimise the potential for any offences to be committed. Mitigation can include the undertaking of vegetation clearance works at an appropriate time of the year and completing works in accordance with methods that will minimise or avoid potential disturbance or destruction of habitats. In such circumstances it is sensible for works to be completed using Reasonable Avoidance Measures (RAMs).

3.3 Planning Policy

- 3.3.1 National and local planning policy relevant to nature conservation is provided in detail in the Preliminary Ecological Appraisal for the Scheme (AECOM, 2020).

3.4 Local Biodiversity Action Plan Species

- 3.4.1 No specific species action plans are listed within the Oxfordshire Biodiversity Action Plan, instead, a list of all UK BAP priority species found within Oxfordshire is provided on the ONCF website (ONCF, 2010^{2,3}).

² Oxfordshire Nature Conservation Forum. (2010a). Oxfordshire's Biodiversity Action Plan and Conservation Target Areas. Available at:

<https://www2.oxfordshire.gov.uk/cms/sites/default/files/folders/documents/environmentandplanning/countryside/naturalenvironment/BAPnewsletterFINAL.pdf> [Accessed April 2020]

³ Oxfordshire Nature Conservation Forum. (2010b). Biodiversity. Available at: <http://www.oncf.org.uk/biodiversity/biodiversity.html> [Accessed April 2020].

4. Methods

4.1 Overview

4.1.1 This section describes the survey methods used to determine the status of Great Crested Newt within the survey area, which included:

- a desk study;
- a Habitat Suitability Index (HSI) survey;
- a presence/absence survey using traditional methods (bottle-trapping, torching, egg-searching and, or netting); and
- environmental DNA (eDNA) analysis.

4.2 Desk Study

4.2.1 A desk study was undertaken in December 2019 through Thames Valley Environmental Records Centre (TVERC) to obtain records of Great Crested Newt within a 2 km radius of the Site and from within the last ten years of the request date. Only records up to ten years old were considered within the assessment, as any records older than ten years are unlikely to be representative of the current status of Great Crested Newts in the local area.

4.2.2 Aerial photographs and Ordnance Survey (OS) maps were reviewed in January 2020 to identify waterbodies and watercourses of potential value to Great Crested Newt within 500 m of the Scheme that were not separated by major barriers to Great Crested Newt dispersal (such as main roads and large rivers). The review of aerial photography and mapping included identifying any key routes of potential connectivity to the Scheme from outside waterbodies and significant barriers to Great Crested Newt dispersal.

4.3 Field Survey

Survey Area

4.3.1 From this desk study, using maps and aerial photography, a total of 51⁴ waterbodies and watercourses were identified as needing to be assessed for their suitability to support Great Crested Newts (refer to Figures 2a and 2b⁴).

4.3.2 From these 51 waterbodies and watercourses:

- the desk study and field surveys scoped out 19 waterbodies and watercourses from requiring any surveys; and
- 32 waterbodies and watercourses were taken forward for further survey.

Habitat Suitability Index (HSI)

4.3.3 The Habitat Suitability Index (HSI) is a measure of habitat suitability, developed by Oldham *et al.* (2000⁵) for evaluating the suitability of waterbodies and watercourses as habitat for Great Crested Newt. The HSI considers ten habitat and ecological

⁴ For the purpose of the Didcot Garden Town Great Crested Newt report, 51 waterbodies and watercourses were identified and numbered as shown in Figures 2a and 2b. Please note that these may be numbered differently in other Didcot Garden Town reports.

⁵ Oldham R.S., Keeble J., Swan M.J.S. & Jeffcote M. (2000). *Evaluating the suitability of habitat for the Great Crested Newt (Triturus cristatus)*. Herpetological Journal 10(4), 143-155.

suitability indices. Waterbodies or watercourses with higher HSI scores are considered more likely to support Great Crested Newt than those with lower scores.

4.3.4 A value is recorded for each parameter and combined to determine an index of breeding suitability for Great Crested Newt (refer to Table 4.1).

Table 4.1: Great Crested Newt suitability indices and description

Suitability Indices	Suitability Indices Title	Suitability Indices Description
(SI ₁)	Geographic location	Different areas of the UK represent different indices scores.
(SI ₂)	Water body area	The optimum water body size is between 500 and 750 m ² .
(SI ₃)	Water body permanence	The optimal frequency of drying is one year per decade.
(SI ₄)	Water quality	The presence of indicator organisms (the same that are used to assess running water) is the water quality indicator.
(SI ₅)	Water body shading	Great crested newt occurrence is significantly reduced above a threshold of 75% shade.
(SI ₆)	Impact of waterfowl	Waterfowl impact on water body vegetation and water turbidity is a negative indicator for great crested newt.
(SI ₇)	Occurrence of fish	The effect of fish presence is related to the species. Some species can have negative impacts and great crested newt hardly ever coexist with larger predatory fish species. Other species (depending on conditions) are not detrimental.
(SI ₈)	Water body density	Water body densities above four water bodies/km ² are taken as optimal.
(SI ₉)	Terrestrial habitat	In general, scrub, unimproved grassland, woodland (deciduous and coniferous) and gardens are regarded as being suitable terrestrial habitat, unlike improved pasture, arable and hardstanding. The SI ₉ is the combination between positive factors (suitable habitat) and negative factors (e.g. inherent in barriers to movement such as roads). The surrounding habitat is scored according to the extent of high-quality terrestrial newt habitat.
(SI ₁₀)	Macrophyte content	The highest occurrence of great crested newt is found in water bodies with emergent vegetation cover between 25% and 50% and submerged vegetation between 50% and 75%.

4.3.5 The HSI generates a numerical index which scores waterbodies and watercourses on a scale of between 0 and 1, using a geometric mean of the ten suitability indices, with the following suitability categories for the results:

- <0.5: poor likelihood of Great Crested Newt presence;
- 0.5 – 0.59: below average likelihood of Great Crested Newt presence;
- 0.6 – 0.69: average likelihood of Great Crested Newt presence;
- 0.7 – 0.79: good likelihood of Great Crested Newt presence; and
- >0.8: excellent likelihood of Great Crested Newt presence.

- 4.3.6 Any waterbody or watercourse with an HSI score of average or greater, should then be surveyed using eDNA analysis or ‘traditional methods’, to determine Great Crested Newt presence or absence.

Great Crested Newt Survey Using Traditional Methods

- 4.3.7 Natural England recommends the following methods are used in order to determine presence or likely absence of Great Crested Newt in waterbodies (English Nature, 2001⁶):
- Three methods (preferably torch surveys, bottle-trapping and egg searching) should be undertaken during each visit with netting as another technique which can be applied if one of the other techniques is not possible;
 - Visits must be undertaken in suitable weather conditions i.e. warm, still evenings without rain;
 - Four presence/absence surveys should be undertaken and, if Great Crested Newts are confirmed, two additional visits (total of six visits) will be required to estimate population class size; and
 - Surveys should be undertaken between mid-March and mid-June with at least two surveys in peak season (usually mid-April to mid-May) with three surveys required between mid-April to mid-May if Great Crested Newts are confirmed within the waterbody.
- 4.3.8 All surveys undertaken for the Scheme were undertaken by experienced Great Crested Newt surveyors who hold Natural England Class (WML-CL08) survey licences for Great Crested Newts, accompanied by unlicensed assistants.

Bottle Trapping

- 4.3.9 This method involves setting bottle-traps, prior to sunset, along the water’s edge of each waterbody. The traps are then left ‘set’ overnight and are checked again the following morning, soon after sunrise.
- 4.3.10 In line with Government Guidance for Covid-19 during the survey period, the use of hotels for overnight stays was restricted. As such, bottle-trapping was not undertaken as the length of driving to and from the Scheme required by each surveyor within 24 hours was not deemed safe.

Torch Survey

- 4.3.11 This technique involves searching a waterbody or watercourse for the presence of Great Crested Newts by shining a high-powered torch (1 million candle power) at night around the margins of a water body and counting the individual animals observed. This method is not suitable for all waterbodies, as vegetation or turbid water may obscure visibility within the water column. During torch surveys, the margins of the waterbodies were walked once, as far as was possible, shining the torch on the waterbody and recording the species and numbers of any newts seen. This method was always undertaken during suitable weather conditions (air temperature >5°C, little or no wind and no rain).

Egg Searches

- 4.3.12 This method involved searching aquatic and marginal vegetation (both living and dead vegetation) within the waterbodies for Great Crested Newt eggs. Once an egg is found and confirmed as that of a Great Crested Newt, the search will be terminated

⁶ Great crested newt mitigation guidelines (English Nature, 2001)

to ensure that no damage or further disturbance to eggs will occur. Great Crested Newt eggs, like those of other newt species, are typically laid within a folded leaf. In order to determine the species of newt egg found, the leaf must be unfolded, rendering it more prone to predation or damage. Numbers of eggs present are not indicative of population size but are an indication of presence.

Netting

- 4.3.13 As bottle-trapping could not be undertaken (see para 4.3.10 above), netting was carried out on all waterbodies and watercourses within the survey area that had an HSI score of average or greater as per the methods in para. 4.3.4. In order not to disturb sediment and adversely affect water clarity for torchlight surveys, netting was conducted after torchlight surveys. Netting was conducted with an Environment Agency approved 2 mm mesh professional dipping net and was targeted at both open water and areas of suitable egg laying vegetation.

E-DNA Analysis

- 4.3.14 Environmental DNA (eDNA) sampling is used to assess the presence or absence of Great Crested Newt DNA from a water sample. This survey methodology is approved by Natural England as providing evidence of presence/absence of Great Crested Newt (Biggs *et al.*, 2014⁷). Natural England has also issued their standing advice, which includes the recommended protocol for eDNA analysis (Gov.UK, 2015⁸). This requires water samples for eDNA to be taken between the 15th April and the 30th June.
- 4.3.15 Field surveys strictly followed the protocol set out in the Technical Advice Note (Biggs *et al.*, 2014⁶) and to prevent contamination of the samples:
- Gloves were worn at all times during the sampling process and gloves were replaced between sample collection from the waterbody and pipetting into the sterile sub-sample tubes; and
 - Samples were collected without entering the water i.e. the surveyor stood only on the waterbody bank or waterbody edges. This prevented disturbance of the substrate to limit cross-contamination.
- 4.3.16 The field sampling protocol consisted of the following steps:
- 20 samples were taken from each waterbody. The location of sub-samples was spaced as evenly as possible around the margin of the waterbody. Subsamples generally targeted areas with potential egg laying substrate (e.g. vegetation) and open water areas which newts may be using for displaying. Prior to sampling, the water column was mixed by gently using a ladle to stir through the entire water column, whilst avoiding disturbing the sediment on the bed of the waterbody. Sampling of very shallow water was avoided where possible (less than 5 - 10 cm deep);
 - A new pair of gloves were put on to keep the next stage as uncontaminated as possible;
 - Using a clear plastic pipette, approximately 15 ml of water was taken from the bag and pipetted into a sterile tube containing 35 ml of ethanol to preserve the eDNA sample (i.e. the tube was filled to the 50 ml mark);

⁷ Biggs, J., Ewald, N., Valentini, A., Gaboriaud, C., Griffiths, R.A., Foster, J., Wilkinson, J., Arnett A., Williams, P. and Dunn, F. (2014) Analytical and methodological development for improved surveillance of the Great Crested Newt. Defra Project WC1067. Freshwater Habitats Trust: Oxford.

⁸ Gov.uk, 2015. Great crested newts: surveys and mitigation for development projects. Available at: <https://www.gov.uk/guidance/great-crested-newts-surveys-and-mitigation-for-development-projects> [Accessed July 2020].

- The tube was shaken vigorously for 10 seconds to mix the sample and preservative. This is essential to prevent DNA degradation and was also repeated for each of the six conical tubes. Before taking each sample, the water in the bag was shaken to homogenise the sample, as DNA material constantly sinks to the bottom; and
- The box of preserved sub-samples was kept in a fridge and then later returned to ambient temperature in the laboratory for analysis.

4.3.17 Laboratory analysis was consistent with the methods described in Appendix 5 of the WC1067 Technical Advice Note (Biggs *et al.*, 2014⁶), including control analysis for inhibition and degradation.

4.3.18 e-DNA kits were procured from ADAS and, after collection of water samples, were then sent back to ADAS to be analysed in their laboratory.

4.4 Population Class Assessment

4.4.1 If Great Crested Newt was found to be present during surveys, the results of the six survey visits are used to produce an approximate indication of the population size class. Based on the maximum count of adult Great Crested Newt, counted per water body per night, the Great Crested Newt population in each waterbody can be classified as small, medium or large, in line with the Great Crested Newt Mitigation Guidelines (English Nature, 2001⁹).

4.4.2 A population of Great Crested Newt is classified using the following indices:

- Small: for maximum counts up to 10;
- Medium: for maximum counts between 11 and 100; and
- Large: for maximum counts over 100.

4.5 Assumptions and Limitations

Desk Study

4.5.1 The aim of a desk study was to help characterise the baseline context of the Scheme and provide valuable background information that will not be captured by a single site survey alone. Information obtained during the course of a desk study is dependent upon people and organisations having made and submitted Great Crested Newt records for the area of interest. As such, a lack of records for a particular habitat or species does not necessarily mean that the habitats or species do not occur in the study area. Likewise, the presence of records for particular habitats and species does not automatically mean that these still occur within the area of interest or were relevant in the context of the Scheme.

Field Survey

4.5.2 Due to Government guidance on COVID-19 issued at the time of the surveys, there were restrictions regarding the use of hotels for overnight stays. As such, it was deemed unsafe for surveyors to carry out bottle trap surveys as the number of hours spent driving to and from the Site will exceed the number of hours deemed safe to drive within a 24 hour period. This is not considered to have impacted the efficacy of the survey in determining presence or absence of Great Crested Newt as three out of the four survey methods (as recommended by Natural England) were undertaken on each waterbody with an HSI of average or greater. Furthermore, to give extra

⁹ English Nature. (2001) Great crested newt mitigation guidelines.

confidence in the results of the presence/absence survey using traditional methods (excluding bottle-trapping), an eDNA survey was carried out on these waterbodies, where appropriate. The programme of survey dates was also influenced by the practicalities of working within Government guidance on COVID-19 and access permissions, which meant some pond clusters were surveyed over a condensed period. However, all surveys were undertaken during the optimal survey period, and this is not considered to have affected the efficacy of data collection.

- 4.5.3 Waterbodies WB15 – 18 within the Berks Bucks & Oxon Wildlife Trust Site (Sutton Courtenay Environmental Education Centre) were not surveyed due to COVID-19 restrictions being in place and safe access was only possible from late June, outside of the optimal survey season. However, during the HSI survey of WB15 – 18, Great Crested Newt were identified close to WB15 and based on the large number of records returned from this site in the data search and the observations made by AECOM during the HSI survey, Great Crested Newt is confirmed as present within the whole Berks Bucks & Oxon Wildlife Trust Site and this will be considered further within the assessment, as appropriate.
- 4.5.4 WB37 and WB45 were found to be dry after the first and second survey visits, so the full four surveys could not be undertaken. Temporary access restrictions to WB33 during the survey period, meant the full complement of surveys were not completed on this waterbody.

5. Results

5.1 Desk Study

- 5.1.1 There was a total of 826 records of Great Crested Newt returned from the TVERC data search. Of the 826 records, 731 were associated with the Sutton Courtenay Environmental Education Centre (Berks Bucks & Oxon Wildlife Trust Site (BBOWT Site)) which is located approximately 400 m north of the A4130. The majority of the remaining 95 records were returned from the Didcot Power Station in 2017 (located approximately 650 m north of the A4130) and Radley Gravel Pits in 2016 (located approximately 1.5 km north of the Scheme). The closest record was returned from WB32, within the Scheme boundary, in 2015.

5.2 Field Surveys

- 5.2.1 Of the 51 waterbodies and watercourses identified within the survey area, 32 were taken forward for further assessments, with the remaining 19 waterbodies and watercourses scoped out. A breakdown of the surveys undertaken and the rationale for these are provided in Table 5.1.

Table 5.1: Summary of Great Crested Newt assessment undertaken for all waterbodies and watercourses, including reason for exclusion from any surveys

Waterbody and Watercourse Reference (with reference to Figures 2a and 2b)	Within the Scheme boundary	Within 500 m of the Scheme boundary	Scoped in for further assessment	HSI Assessment carried out?	Traditional survey methods carried out?	E-DNA Analysis carried out?	Reason for exclusion from any surveys
WB1	No	Yes	Yes	Yes	No	No	Road network surrounding this waterbody will act as a barrier to dispersal of Great Crested Newt to/from this pond.
WB2	No	Yes	No	-	-	-	Dry ditch unsuitable for Great Crested Newt.
WB3	No	Yes	Yes	Yes	Yes	No	No Great Crested Newts found during four 'traditional methods' surveys.
WB4	No	Yes	No	-	-	-	Dry ditch unsuitable for Great Crested Newt.
WB5	No	Yes	Yes	Yes	Yes	No	No Great Crested Newts found during four 'traditional methods' surveys.
WB6	No	Yes	Yes	Yes	Yes	No	No Great Crested Newts found during four 'traditional methods' surveys.
WB7	No	Yes	Yes	Yes	Yes	No	No Great Crested Newts found during four 'traditional methods' surveys.
WB8	No	Yes	No	-	-	-	Dry ditch unsuitable for Great Crested Newt.
WB9	No	Yes	No	-	-	-	Dry ditch unsuitable for Great Crested Newt.

Waterbody and Watercourse Reference (with reference to Figures 2a and 2b)	Within the Scheme boundary	Within 500 m of the Scheme boundary	Scoped in for further assessment	HSI Assessment carried out?	Traditional survey methods carried out?	E-DNA Analysis carried out?	Reason for exclusion from any surveys
WB10	No	Yes	No	-	-	-	Dry ditch unsuitable for Great Crested Newt.
WB11	No	Yes	No	-	-	-	Barriers to dispersal between this waterbody and Site.
WB12	No	Yes	No	-	-	-	Barriers to dispersal between this waterbody and Site.
WB13	No	Yes	No	-	-	-	Barriers to dispersal between this waterbody and Site.
WB14	No	Yes	No	-	-	-	Barriers to dispersal between this waterbody and Site.
WB15	No	Yes	Yes	Yes	No	No	Access granted after survey season. Known Great Crested Newt population present in area.
WB16	No	Yes	Yes	Yes	No	No	Access granted after survey season. Known Great Crested Newt population present in area.
WB16a	No	No	Yes	Yes	No	No	Access granted after survey season. Known Great Crested Newt population present in area.
WB16b	No	No	Yes	Yes	No	No	Access granted after survey season. Known Great Crested Newt population present in area.

Waterbody and Watercourse Reference (with reference to Figures 2a and 2b)	Within the Scheme boundary	Within 500 m of the Scheme boundary	Scoped in for further assessment	HSI Assessment carried out?	Traditional survey methods carried out?	E-DNA Analysis carried out?	Reason for exclusion from any surveys
WB16c	No	No	Yes	Yes	No	No	Access granted after survey season. Known Great Crested Newt population present in area.
WB17	No	Yes	Yes	Yes	No	No	Access granted after survey season. Known Great Crested Newt population present in area.
WB18	No	Yes	Yes	Yes	No	No	Access granted after survey season. Known Great Crested Newt population present in area.
WB19	No	Yes	No	-	-	-	Dry ditch unsuitable for Great Crested Newt.
WB20	No	Yes	No	-	-	-	Dry ditch unsuitable for Great Crested Newt.
WB21	No	Yes	No	-	-	-	Unvegetated, ditch with concrete basin and very low water levels. Unsuitable for Great Crested Newt.
WB22	No	Yes	No	-	-	-	Unvegetated, concrete basin waterbody, with noticeable poor/turbid water quality. Unsuitable for Great Crested Newt.
WB23	No	Yes	Yes	Yes	No	No	Access granted after survey season. Known Great Crested Newt population present in the area.

Waterbody and Watercourse Reference (with reference to Figures 2a and 2b)	Within the Scheme boundary	Within 500 m of the Scheme boundary	Scoped in for further assessment	HSI Assessment carried out?	Traditional survey methods carried out?	E-DNA Analysis carried out?	Reason for exclusion from any surveys
WB24	No	Yes	Yes	Yes	Yes	Yes	-
WB25	No	Yes	Yes	Yes	Yes	Yes	-
WB25a	No	Yes	Yes	Yes	No	No	Waterbody dried out by time of survey.
WB26	Yes	Yes	No	-	-	-	Waterbody with a concrete basin; unsuitable for Great Crested Newt.
WB27	Yes	Yes	No	-	-	-	Waterbody with a concrete basin unsuitable for Great Crested Newt.
WB28	No	Yes	No	-	-	-	Dry waterbody unsuitable for Great Crested Newt.
WB29	Yes	Yes	Yes	Yes	No	Yes	HSI score poor – not included for survey using traditional methods but included for eDNA as anecdotal evidence that Great Crested Newt was present.
WB30	Yes	Yes	Yes	Yes	Yes	Yes	-
WB31	Yes	Yes	Yes	Yes	Yes	Yes	-
WB31a	Yes	Yes	Yes	Yes	Yes	Yes	-
WB32	Yes	Yes	Yes	Yes	Yes	Yes	-
WB33	No	Yes	Yes	Yes	Yes	Yes	Incomplete traditional methods surveys, due to temporary access restrictions.
WB34	No	Yes	Yes	Yes	Yes	Yes	-

Waterbody and Watercourse Reference (with reference to Figures 2a and 2b)	Within the Scheme boundary	Within 500 m of the Scheme boundary	Scoped in for further assessment	HSI Assessment carried out?	Traditional survey methods carried out?	E-DNA Analysis carried out?	Reason for exclusion from any surveys
WB35	No	Yes	No	-	-	-	Barriers and distance to dispersal between this waterbody and Site.
WB36	Yes	Yes	Yes	Yes	Yes	Yes	-
WB37	Yes	Yes	Yes	Yes	Yes	No	Waterbody found to be dry on second visit of traditional survey – not suitable for eDNA.
WB37a	No	Yes	Yes	Yes	Yes	Yes	-
WB38	No	Yes	Yes	Yes	No	No	HSI - Poor
WB39	No	Yes	No	-	-	-	Unvegetated, recently disturbed quarry excavation, with limited standing water. Unsuitable for Great Crested Newt.
WB40	Yes	Yes	Yes	Yes	No	No	HSI – Below average
WB41	Yes	Yes	Yes	Yes	No	No	HSI – Below average
WB42	No	Yes	Yes	Yes	Yes	Yes	-
WB43	No	Yes	Yes	Yes	No	Yes	HSI score poor – not included for survey using traditional methods but included for eDNA as anecdotal evidence that Great Crested Newt were present.
WB44	No	Yes	No	-	-	-	Very small garden pond with liner.

Waterbody and Watercourse Reference (with reference to Figures 2a and 2b)	Within the Scheme boundary	Within 500 m of the Scheme boundary	Scoped in for further assessment	HSI Assessment carried out?	Traditional survey methods carried out?	E-DNA Analysis carried out?	Reason for exclusion from any surveys
WB45	No	Yes	Yes	Yes	Yes	No	Waterbody found to be dry on second visit of traditional survey – not suitable for eDNA.

Habitat Suitability Index (HSI)

5.2.2 HSIs were undertaken for 32 waterbodies and watercourses within the survey area. The results of the HSIs are presented in Appendix A, Table A1.

5.2.3 In summary, of the 32 waterbodies surveyed using HSI methods:

- Six had ‘excellent’ suitability to support breeding Great Crested Newt;
- Six had ‘good’ suitability to support breeding Great Crested Newt;
- 11 had ‘average’ suitability to support breeding Great Crested Newt;
- Five had ‘below average’ to support breeding Great Crested Newt; and
- Four had ‘poor’ suitability to support breeding Great Crested Newt.

5.2.4 Whilst conducting HSI surveys on WB15, WB16, WB16a, WB16b, WB16c, WB17 and WB18 within the Berks Bucks & Oxon Wildlife Trust Site (Sutton Courtenay Environmental Education Centre), five Great Crested Newts were found under a pile of logs at Ordnance Survey grid reference SU 50100 91824, close to WB16.

Great Crested Newt Survey Using Traditional Methods

5.2.5 Given the size of the Scheme and distance between waterbodies and watercourses (and how many could be surveyed on one night by two people), the 17 waterbodies and watercourses that were surveyed using traditional methods were split into three separate clusters (as shown in Figures 2a and 2b) which are as follows:

- Cluster 1 – WB30, WB32, WB34, WB36, WB37, WB37a and WB42;
- Cluster 2 – WB3, WB5, WB6, WB7, WB24 and WB25; and
- Cluster 3 – WB31, WB31a, WB33 and WB45.

5.2.6 Great Crested Newt surveys using traditional methods were conducted between April and May 2020. The dates and weather conditions for each survey visit are presented in Table 5.2.

Table 5.2: Survey dates and weather conditions for each survey visit

Pond Cluster	Visit	Dates	Air Temp (°C) at time of Torching	Weather Conditions
1	1	8 th April 2020	16	Dry, Cloud 1/8, Wind F1
	2	23 rd April 2020	18	Dry, Cloud 4/8, Wind F1
	3	29 th April 2020	10	Dry, Cloud 7/8, Wind F2
	4	19 th May 2020	16	Dry, Cloud 1/8, Wind F1
2	1	16 th April 2020	13	Dry, Cloud 1/8, Wind F1
		18 th April 2020	13	Dry, Cloud 0/8, Wind F1
	2	27 th April 2020	13	Dry, Cloud 6/8, Wind F4
	3	6 th May 2020	10	Dry, Cloud 3/8, Wind F2
	4	18 th May 2020	8	Dry, Cloud 1/8, Wind F1
3	1	14 th May 2020	10	Dry, Cloud 0/8, Wind F2
	2	18 th May 2020	16	Dry, Cloud 2/8, Wind F1
	3	18 th May 2020	16	Dry, Cloud 2/8, Wind F1
		20 th May 2020	19	Dry, Cloud 0/8, Wind F1

Pond Cluster	Visit	Dates	Air Temp (°C) at time of Torching	Weather Conditions
	4	20 th May 2020	19	Dry, Cloud 0/8, Wind F1
Notes on Table 5.2: Wind speed is shown using the Beaufort scale, which is an empirical measure of force 0 - 12 that relates wind speed to observed conditions. Cloud cover is shown in a scale of 0 - 8 where the number represents the amount of cloud cover e.g. 2/8 is 25% cover 4/8 is 50% etc.				

5.2.7 No Great Crested Newt were recorded in any of the surveyed waterbodies and watercourses. The results for the Great Crested Newt survey using traditional methods are presented in Appendix A, Tables A2, A3 and A4.

5.2.8 Smooth Newt *Lissotriton vulgaris* was found to be present in 12 waterbodies (WB30, WB32, WB34, WB36, WB37a, WB24 and WB31a).

5.2.9 Details of the number of Smooth Newts found in each waterbody and watercourse, as well as other species found, are detailed in Appendix A, Tables A2, A3 and A4.

e-DNA Analysis

5.2.10 Given the limitations with surveying for Great Crested Newt using traditional methods (see Section 4.5), to confirm the absence of Great Crested Newt, water samples were taken from 13 waterbodies on 9th June 2020 and analysed by the ADAS Laboratory in Helsby on 11th June 2020. Lead ecologists undertaking the sampling were registered to hold a Natural England Great Crested Newt survey Class 1 licence and had appropriate training for eDNA sampling surveys.

5.2.11 The results of these eDNA analysis are presented in Table 5.3.

Table 5.3: eDNA survey results

Waterbody and Watercourse Reference	eDNA Detection Results
WB24	Negative
WB25	Negative
WB29	Negative
WB30	Negative
WB31	Negative
WB31a	Negative
WB32	Negative
WB33	Negative
WB34	Negative
WB36	Negative
WB37a	Negative
WB42	Negative
WB43	Negative

5.2.12 All waterbodies surveyed for eDNA tested negative and therefore confirm the results of the surveys using traditional methods, that these waterbodies do not support Great Crested Newt.

6. Conclusions and Recommendations

6.1 Conclusions

- 6.1.1 No Great Crested Newt were recorded within any of the waterbodies or watercourses surveyed within the Scheme boundary during the Great Crested Newt survey using traditional methods.
- 6.1.2 Five Great Crested Newt were recorded within the Sutton Courtenay Environmental Education Centre (BBOWT Site), which is approximately 360 m from the Scheme boundary.
- 6.1.3 The TVERC data search returned a record of Great Crested Newt from within the Scheme boundary at WB32 in 2015. However, eDNA analysis found this waterbody to be negative for the presence of Great Crested Newt eDNA and so it is concluded that Great Crested Newt is not present within WB32.

6.2 Sutton Courtenay Environmental Education Centre (BBOWT Site)

- 6.2.1 Five Great Crested Newts were found within the Sutton Courtenay Environmental Education Centre (BBOWT Site) close to WB16, as shown in Figures 3a, 3b and 3c. The TVERC data search returned 731 records of Great Crested Newt within Sutton Courtenay Environmental Education Centre from 2010 – 2019. Furthermore, HSI scores for the waterbodies within this area (WB15, WB16, WB16a, WB16b, WB16c, WB17 and WB18 on Figures 3a, 3b and 3c) were all scored as being ‘good’ to ‘excellent’ likelihood to support Great Crested Newt.
- 6.2.2 Therefore, it is highly likely that all the waterbodies within Sutton Courtenay Environmental Education Centre have Great Crested Newt present. Figures 3a, 3b and 3c outline the Sutton Courtenay Environmental Education Centre (BBOWT Site) reserve boundary and the location of the waterbodies.
- 6.2.3 Connectivity between the Scheme and Sutton Courtenay Environmental Education Centre is limited with dry ditches (such as WB19) and other waterbodies and watercourses that are unsuitable for Great Crested Newt. To support this, no Great Crested Newt was present within waterbodies and watercourses surveyed between the BBOWT site and the Scheme.
- 6.2.4 Furthermore, industrial buildings, a small road, a railway track and the A4130 all inhibit Great Crested Newt dispersal from the waterbodies within Sutton Courtenay Environmental Education Centre moving to the Scheme.
- 6.2.5 Given that there are significant barriers to dispersal and no hydrological connections to waterbodies or watercourses outside of the Sutton Courtenay Environmental Education Centre reserve boundary, it is highly unlikely that Great Crested Newt is present within the Scheme boundary and this is further substantiated by the results of the surveys as reported herein. However, a precautionary method of working will be adopted during construction of the Scheme within 500 m of the Sutton Courtenay Environmental Education Centre – refer to Section 6.3.

- 6.2.6 An assessment of the impacts on Great Crested Newts will be presented in the Environmental Statement.
- 6.2.7 Habitat enhancement and creation measures will be proposed as part of the ecological mitigation and enhancement strategy and subsequently contribute to biodiversity net gain.

Appendix A HSI and Survey Results

Table A 1: Habitat Suitability Index Scores for waterbodies and watercourses assessed

Waterbody and Watercourse Reference	HSI Score
WB1	0.73
WB3	0.67
WB5	0.67
WB6	0.62
WB7	0.64
WB15	0.70
WB16	0.89
WB16a	0.90
WB16b	0.80
WB16c	0.85
WB17	0.88
WB18	0.81
WB23	0.61
WB24	0.65
WB25	0.63
WB25a	0.53
WB29	0.47
WB30	0.58
WB31	0.46
WB31a	0.69
WB32	0.77
WB33	0.69
WB34	0.64
WB36	0.73
WB37	0.73
WB37a	0.67
WB38	0.47
WB40	0.55
WB41	0.53
WB42	0.75
WB43	0.45
WB45	0.53
HSI Score colour coding – Dark green: Excellent likelihood of Great Crested Newt present; Light green – Good likelihood of Great Crested Newt present; Yellow – Average likelihood of Great Crested Newt present; Orange – Below average likelihood of Great Crested Newt present; and Red – Poor likelihood of Great Crested Newt present.	

Table A 2: Great Crested Newt Survey using traditional methods results for Cluster 1

Waterbody Reference (with reference to Figures 2a and 2b)	Survey Visit	Egg Search	Great Crested Newt Count (Adults Only) (M – Male; F – Female)		Smooth Newt Count (Adults Only) (M – Male; F – Female)		Other Species
			Netting	Torching	Netting	Torching	
30	1	Nothing found	0	0	0	15 M and 14 F	Signal Crayfish (<i>Pacifastacus leniusculus</i>) present in large numbers
	2	Nothing found	0	0	0	8 M and 8 F	Signal Crayfish present in large numbers
	3	Nothing found	0	0	2 M and 1 F	23 M and 26 F	Signal Crayfish present in large numbers
	4	Nothing found	0	0	0	3 M and 1 F	Signal Crayfish present in large numbers
32	1	Smooth Newt egg	0	0	0	30 M and 24 F	25 Common Toads (<i>Bufo bufo</i>)
	2	Nothing found	0	0	0	10 M and 12 F	Common Toad and tadpoles present
	3	Nothing found	0	0	0	9 M and 8 F	Tadpoles present
	4	Nothing found	0	0	0	1 M and 3 F	Large Common (or Eurasian) Carp (<i>Cyprinus carpio</i>) and small fish present
34	1	Nothing found	0	0	0	4F	-
	2	Nothing found	0	0	0	0	-
	3	Nothing found	0	0	0	4 F	-
	4	Nothing found	0	0	0	0	-
36	1	Nothing found	0	0	0	1 M	-
	2	Nothing found	0	0	0	3 M and 4 F	-
	3	Nothing found	0	0	0	1 M	-

Waterbody Reference (with reference to Figures 2a and 2b)	Survey Visit	Egg Search	Great Crested Newt Count (Adults Only) (M – Male; F – Female)		Smooth Newt Count (Adults Only) (M – Male; F – Female)		Other Species
			Netting	Torching	Netting	Torching	
	4	Nothing found	0	0	0	1 M	Stickleback (<i>Gasterosteidae</i>) fish present
37	1	Quicksand present – no survey	Quicksand present – no survey	0	Quicksand present – no survey	0	-
	2	Dry	Dry	Dry	Dry	Dry	-
	3	Dry	Dry	Dry	Dry	Dry	-
	4	Dry	Dry	Dry	Dry	Dry	-
37a	1	Quicksand present, no survey.	Quicksand present, no survey.	0	Quicksand present, no survey.	42 M and 37 F	2 Common Toads
	2	Quicksand present - no survey	Quicksand present - no survey	0	Quicksand present - no survey	38 M and 35 F	-
	3	Quicksand present - no survey	Quicksand present - no survey	0	Quicksand present - no survey	12 M and 14 F	-
	4	Quicksand present - no survey	Quicksand present - no survey	0	Quicksand present - no survey	3 M and 3 F	Grass Snake (<i>Natrix natrix</i>) seen in water
42	1	Nothing found	0	0	0	0	-
	2	Nothing found	0	0	0	0	Gudgeon (<i>Gobio gobio</i>) present
	3	Nothing found	0	0	0	0	
	4	Nothing found	0	0	0	0	

Table A 3: Great Crested Newt Survey using traditional methods results for Cluster 2

Waterbody Reference (with reference to Figures 2a and 2b)	Survey Visit	Egg Search	Great Crested Newt Count (Adults Only) (M – Male; F – Female)		Smooth Newt Count (Adults Only) (M – Male; F – Female)		Other Species
			Netting	Torching	Netting	Torching	
3	1	Nothing found	0	0	0	0	Three-spined Stickleback (<i>Gasterosteus aculeatus</i>) caught during netting
	2	Nothing found	0	0	0	0	Waterfowl present
	3	Nothing found	0	0			
	4	Nothing found	0	0	0	0	Waterfowl and fish present
5	1	Nothing found	0	0	0	0	Fish present
	2	Nothing found	0	0	0	0	Waterfowl present
	3	Nothing found	0	0	0	0	-
	4	Nothing found	0	0	0	0	Waterfowl present
6	1	Nothing found	0	0	0	0	-
	2	Nothing found	0	0	0	0	Waterfowl present
	3	Nothing found	0	0	0	0	-
	4	Nothing found	0	0	0	0	Waterfowl present
7	1	Nothing found	0	0	0	0	-
	2	Nothing found	0	0	0	0	Waterfowl present
	3	Nothing found	0	0	0	0	-
	4	Nothing found	0	0	0	0	Waterfowl present
24	1	Nothing found	0	0	1 M	5 M and 2 F	2 Common Frogs, 2 Common Toad, 100+ tadpoles. Patches of New Zealand Pigmyweed (<i>Crassula helmsii</i>) found in pond.
	2	Nothing found	0	0	0	1 M and 1F	

Waterbody Reference (with reference to Figures 2a and 2b)	Survey Visit	Egg Search	Great Crested Newt Count (Adults Only) (M – Male; F – Female)		Smooth Newt Count (Adults Only) (M – Male; F – Female)		Other Species
			Netting	Torching	Netting	Torching	
25	3	Nothing found	0	0	0	24	-
	4	Nothing found	0	0	0	0	-
	1	Nothing found	0	0	0	0	1000+ tadpoles, 1 Common Frog
	2	Nothing found	0	0	0	0	-
	3	Nothing found	0	0	0	0	-
	4	Nothing found	0	0	0	0	500+ Common Frog tadpoles

Table A 4: Great Crested Newt Survey using traditional methods results for Cluster 3

Waterbody Reference (with reference to Figures 2a and 2b)	Survey Visit	Egg Search	Great Crested Newt Count (Adults Only) (M – Male; F – Female)		Smooth Newt Count (Adults Only) (M – Male; F – Female)		Other Species
			Netting	Torching	Netting	Torching	
31	1	Nothing found	0	0	0	0	Large amounts of New Zealand Pigmyweed present
	2	Nothing found	0	0	0	0	-
	3	Nothing found	0	0	0	0	Wildfowl present
	4	Nothing found	0	0	0	0	Wildfowl and large fish present
31a	1	Nothing found	0	0	Smooth Newt larvae	24 M and 21 F	Large amounts of New Zealand Pigmyweed present
	2	Nothing found	0	0			-
	3	Nothing found (too late in season for eggs but many	0	0	1 M and 1F and Smooth Newt efts	1 M	Stickleback fish present

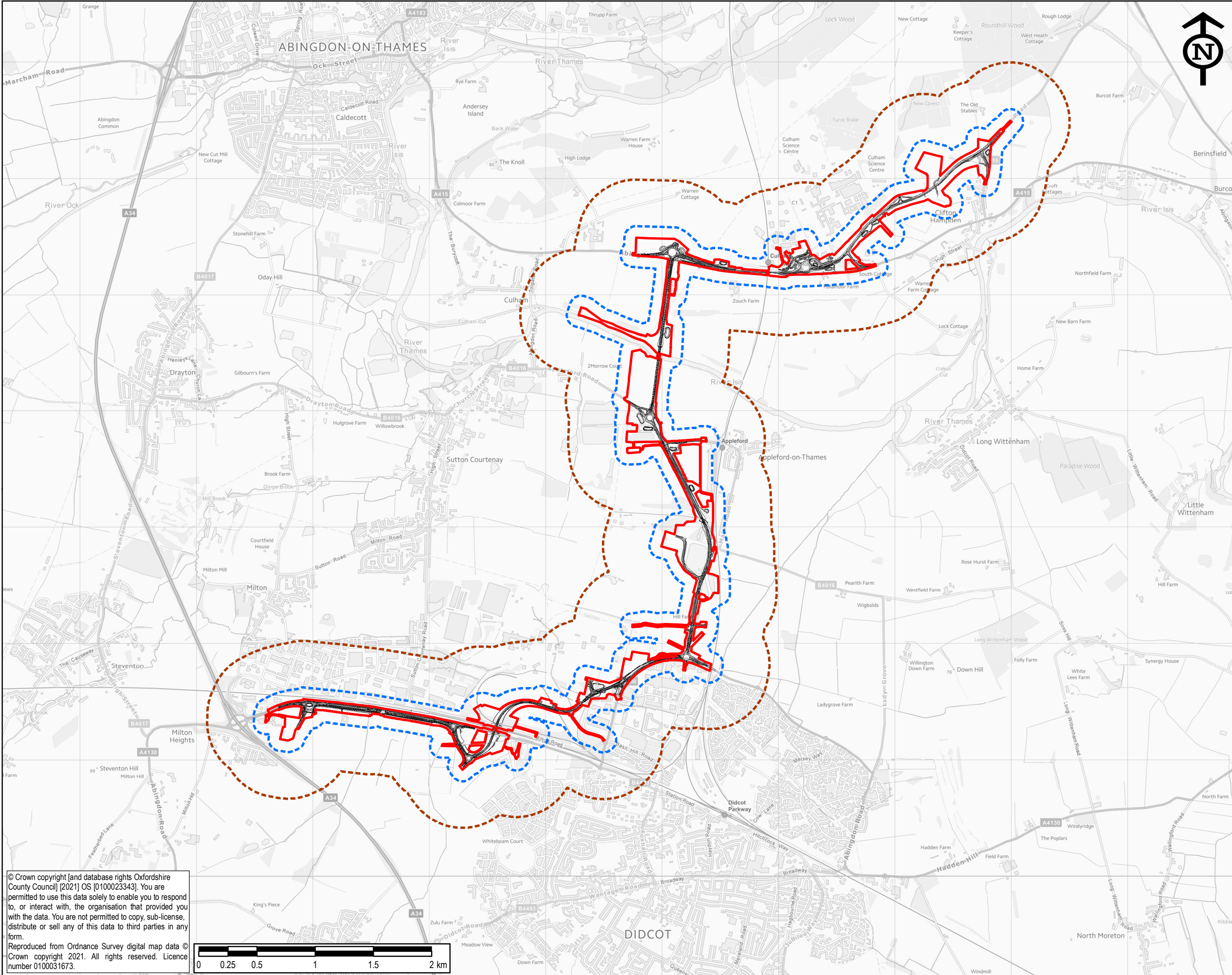
Waterbody Reference (with reference to Figures 2a and 2b)	Survey Visit	Egg Search	Great Crested Newt Count (Adults Only) (M – Male; F – Female)		Smooth Newt Count (Adults Only) (M – Male; F – Female)		Other Species
			Netting	Torching	Netting	Torching	
		Smooth Newt Efts)					
	4	Nothing found (too late in season for eggs but many Smooth Newt Efts)	0	0	0	10 M and 5 F	
33	1	Nothing found	0	0	0	0	Survey stopped due to access issues
	No further surveys carried out due to access issues.						
45	1	Nothing found	0	0	0	0	Common Toads and tadpoles present
	2	Nothing found	0	0	0	0	Common Toad tadpoles present
	3	Dry					
	4	Dry					

Appendix B Figures

Figure 1: Scheme Layout

Figure 2: Great Crested Newt Survey Area

Figure 3: Great Crested Newt Data Search Records



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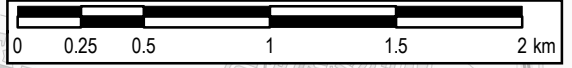
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- Indicative OCC Highway Design (Subject to Change)
- 100m Study Area
- 500m Study Area

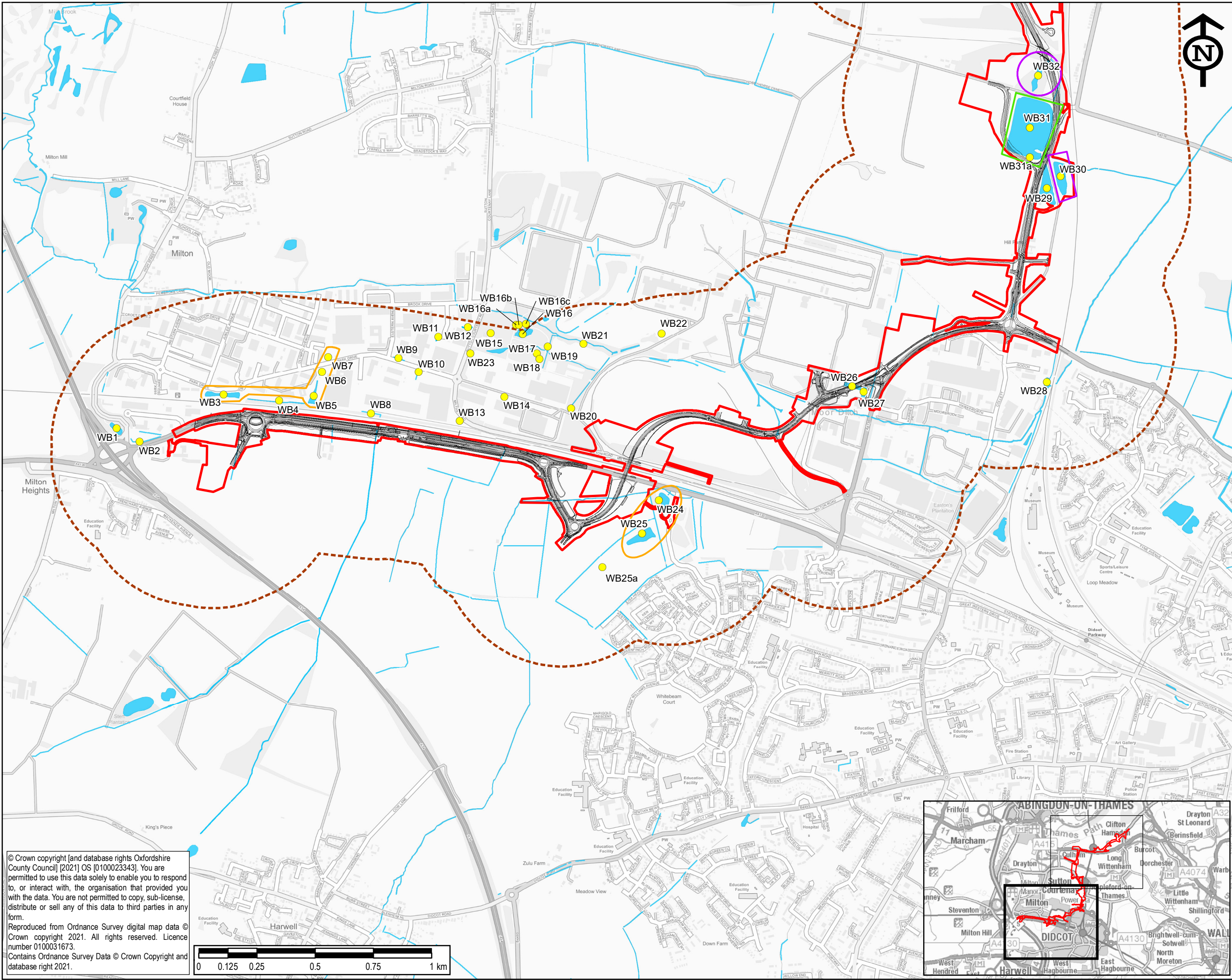
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DIDCOT GARDEN TOWN HIF 1 SCHEME				
Drawing Title				
FIGURE 1 SCHEME LOCATION				
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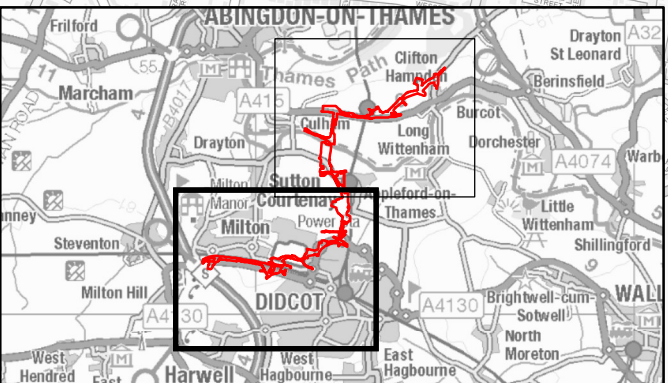
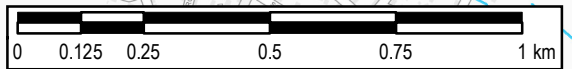
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- Indicative OCC Highway Design (Subject to Change)
- 500m Study Area
- Surface Water
- Cluster 01
- Cluster 02
- Cluster 03
- Waterbodies & Watercourses

First Issue	AG	PC	02/07/2021	P01
Revision Details	By	Check	Date	Suffix
Purpose of Issue	FOR INFORMATION			
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Project Title	DIDCOT GARDEN TOWN HIF 1 SCHEME			
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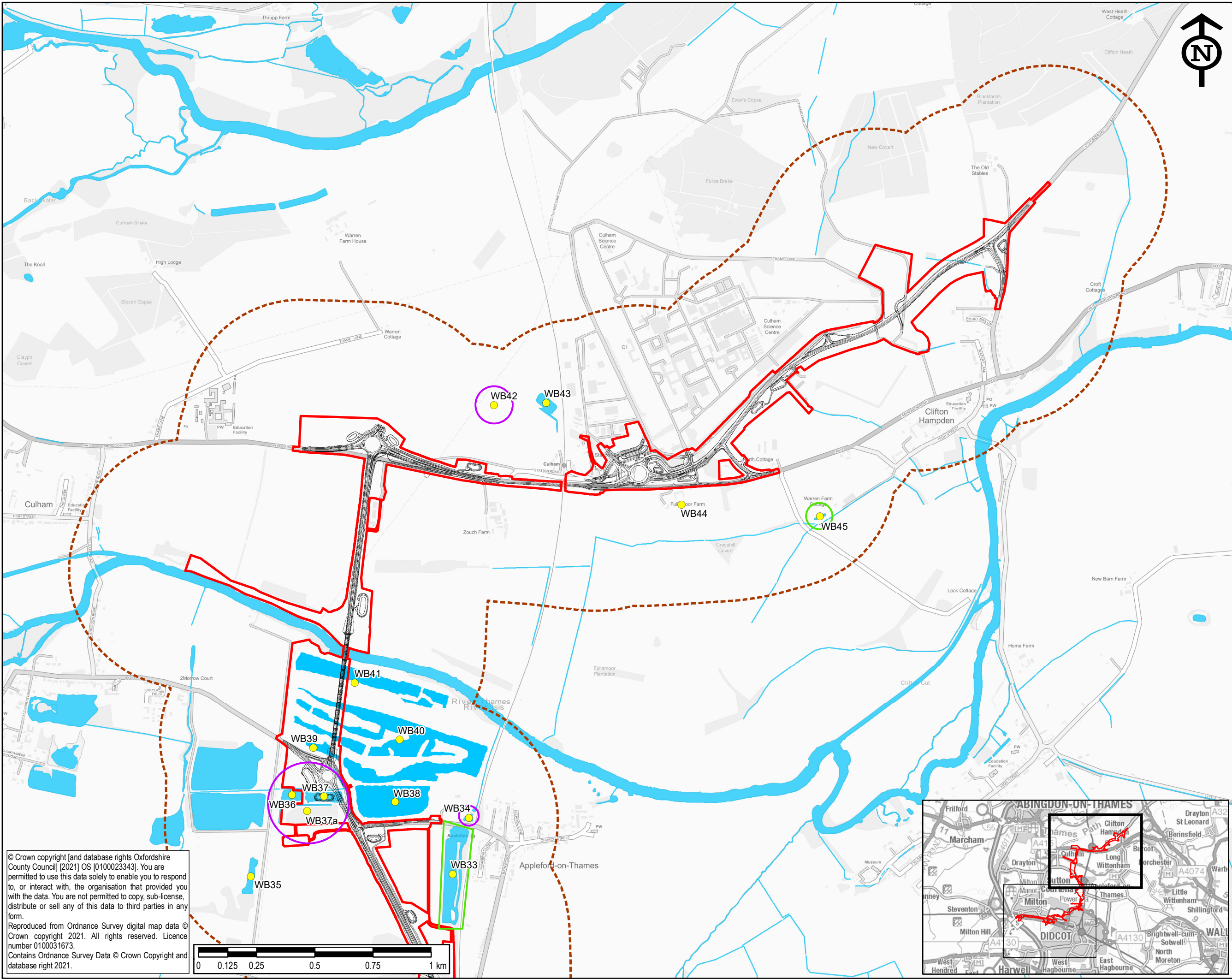
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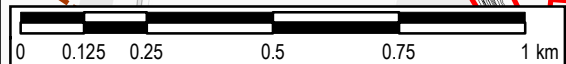
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- 500m Study Area
- Surface Water
- Cluster 01
- Cluster 02
- Cluster 03
- Waterbodies & Watercourses

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**FIGURE 2B
GREAT CRESTED NEWT PONDS**

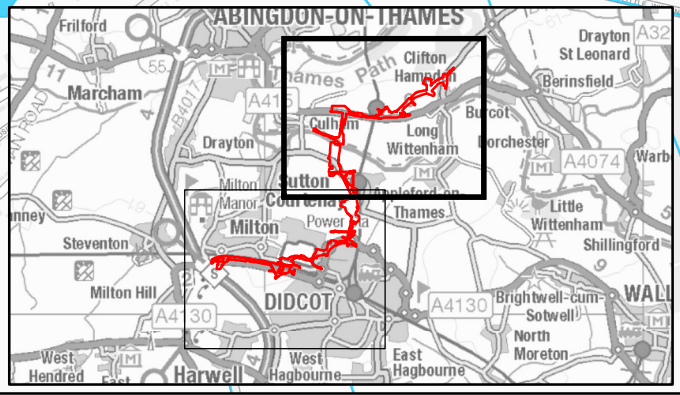
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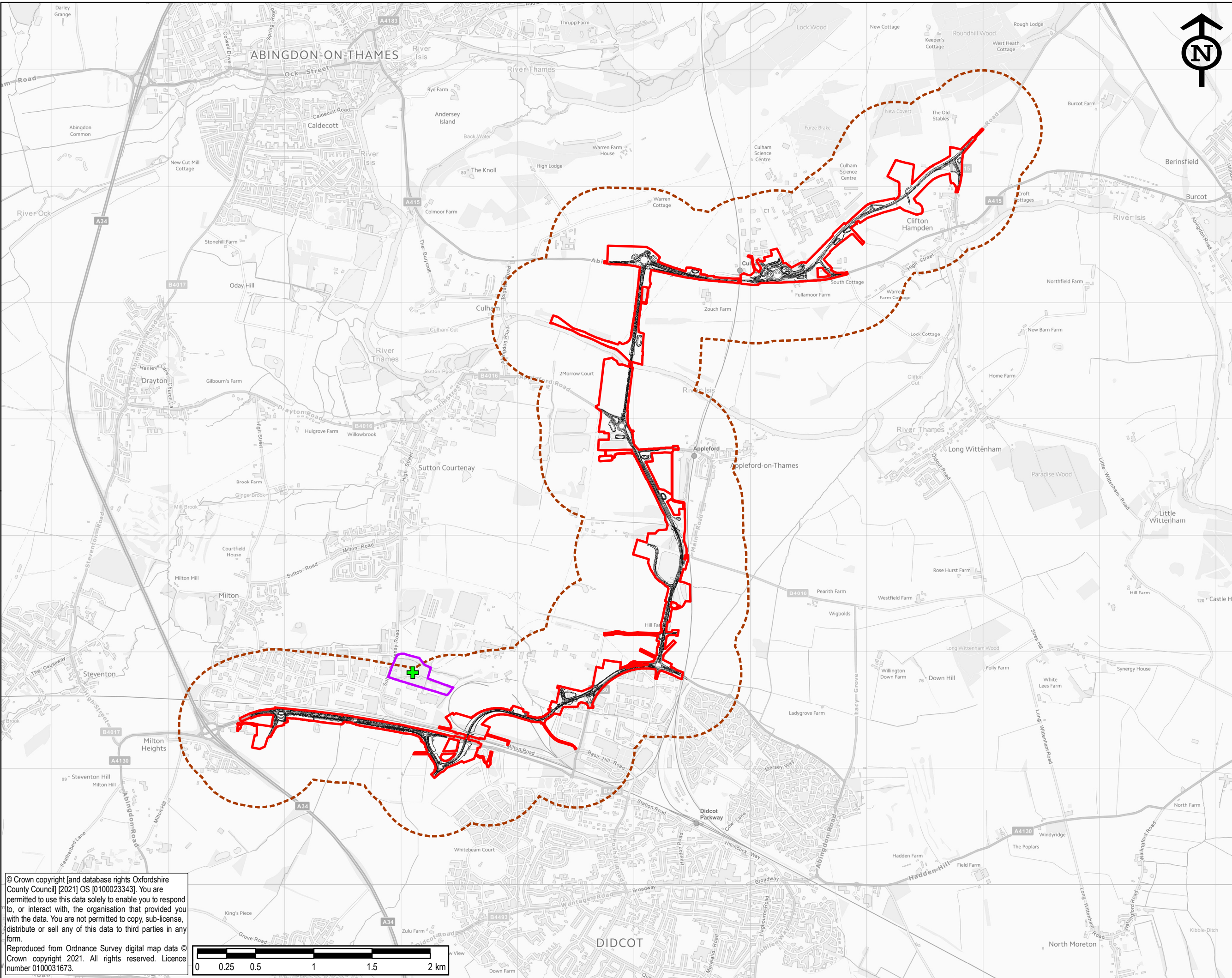
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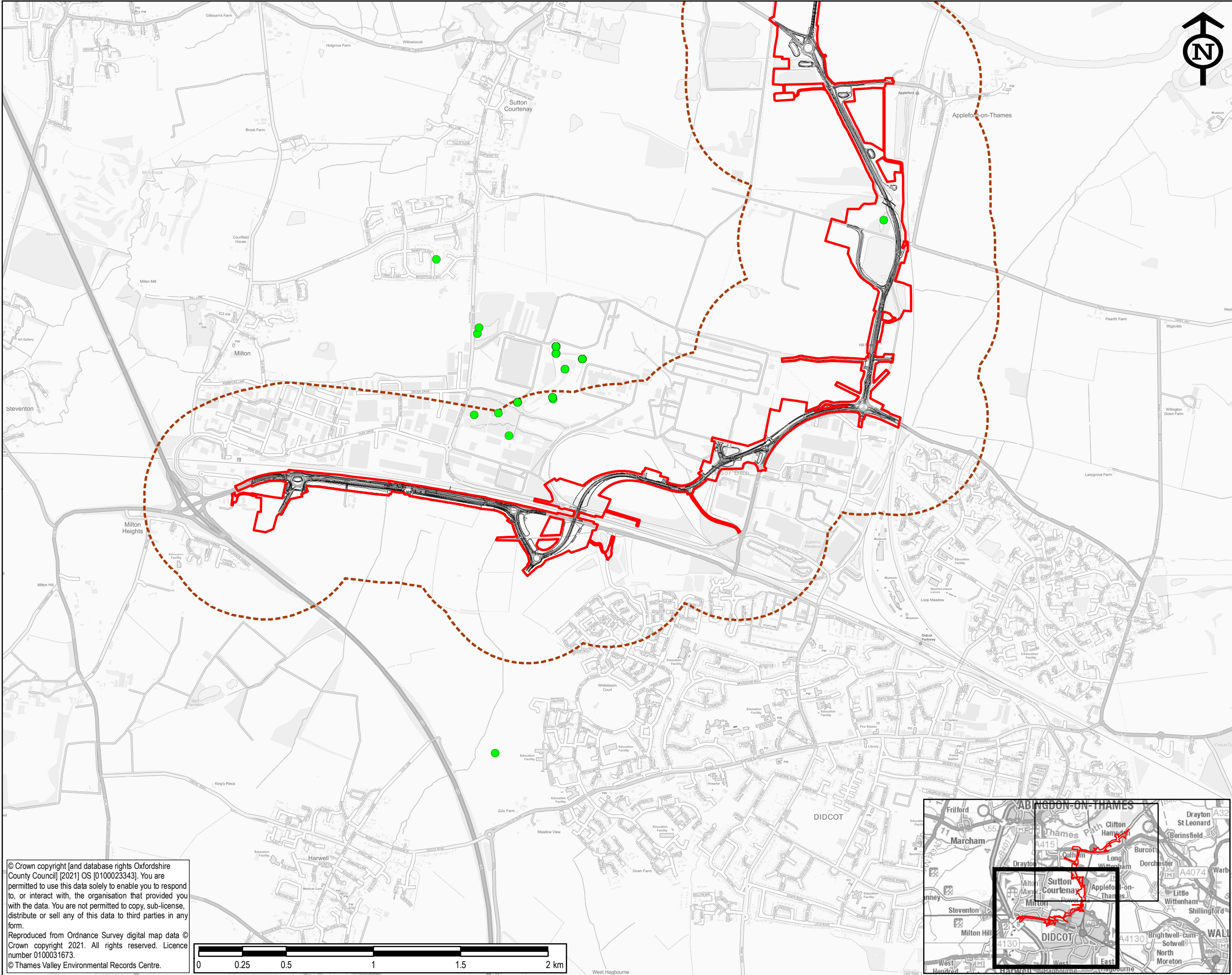
LEGEND

- Indicative Red Line Boundary (Subject to Change)
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- 500m Study Area
- Sutton Courtenay Reserve Boundary
- Great Crested Newts Found

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FIGURE 3				
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- 500m Study Area
- Thames Valley Environmental Records Centre Great Crested Newts

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FIGURE 4A
GREAT CRESTED NEWT RESULT

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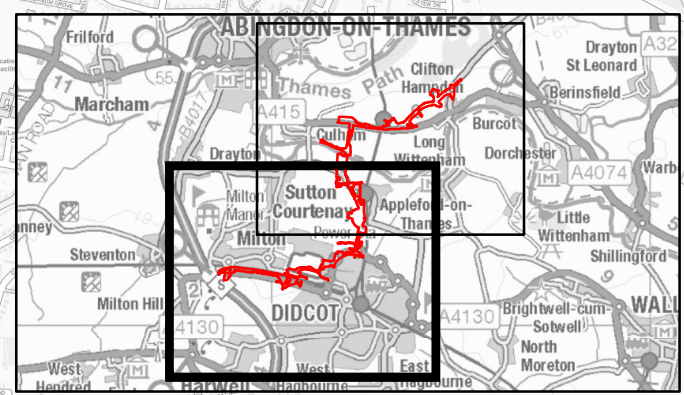
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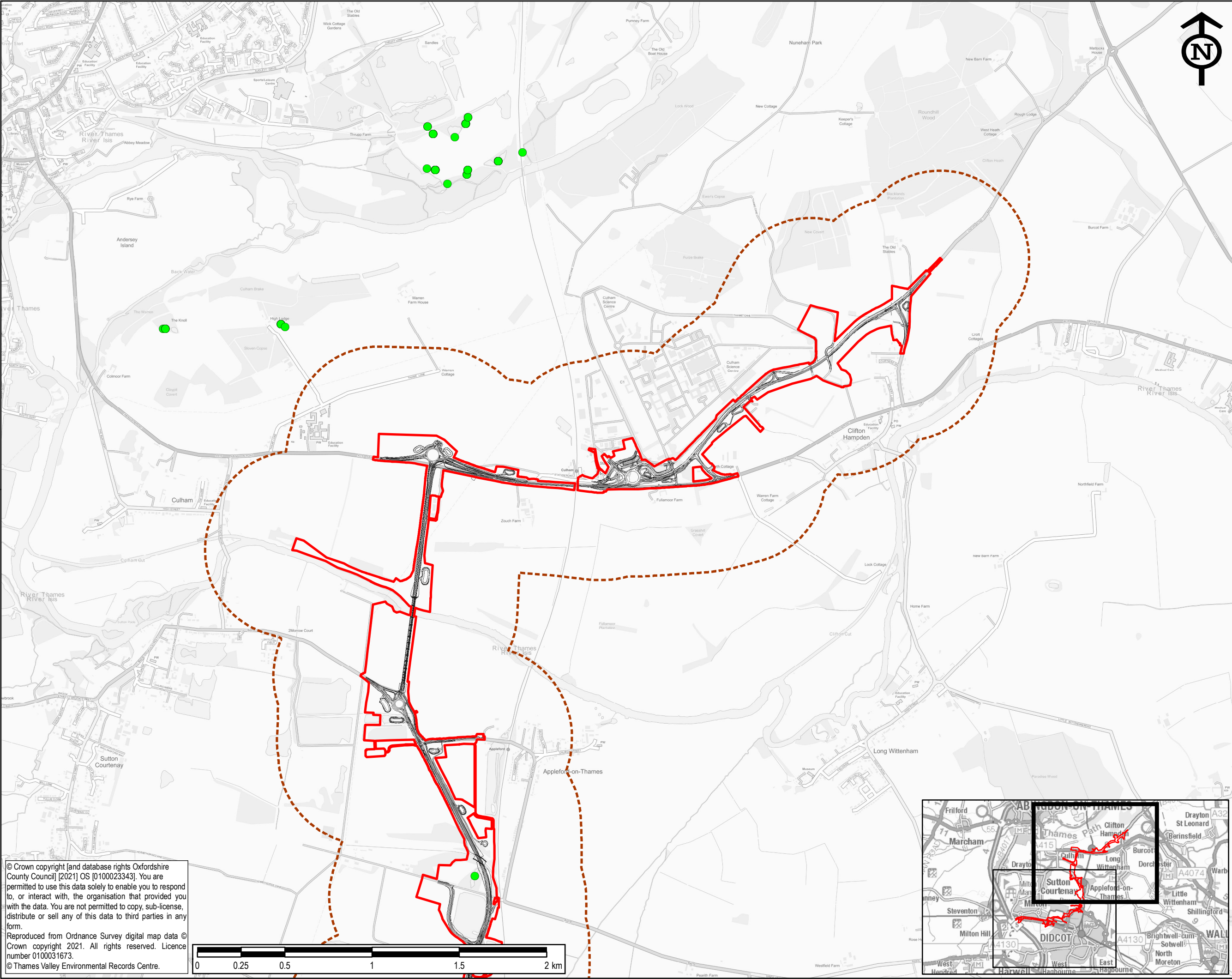
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FIGURE 4B

GREAT CRESTED NEWT RESULT

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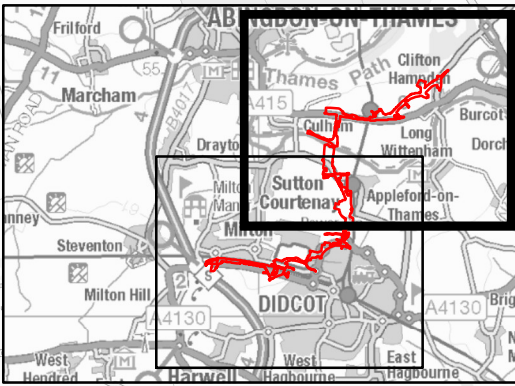
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Annex 8 – Appendix 9.7: Breeding Birds Survey Report



REVISED

Didcot Garden Town HIF 1 Scheme

Environmental Statement

Volume III

Appendix 9.7: Report on surveys for Breeding Birds

October 2022

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Executive Summary

AECOM was instructed by Oxfordshire County Council (the client) to undertake a survey of breeding birds for the proposed Didcot Garden Town HIF (hereafter referred to as the Scheme). The Scheme comprises four improvement sites between the Milton Interchange Service Area in the west, and the B4015 north-east of Clifton Hamden.

The objective of the surveys for breeding birds was to determine the presence and assemblage of breeding bird species within the Site and within 100 m of the Site boundary with an emphasis on species of conservation concern. The survey comprised six survey visits undertaken between April and June 2020 and species-specific surveys undertaken between March and August 2020 for those species listed on Schedule 1 of the Wildlife and Countryside Act (as amended) 1981.

This report contains confidential information regarding the locations of sensitive breeding species, included on Schedule 1 of the Wildlife and Countryside Act (1981, as amended). Therefore, this report should not be circulated outside of the immediate project team.

The survey recorded 87 bird species within the survey area, and breeding territories of 53 species were confirmed within the survey area with a further 14 species probably or possibly holding breeding territories within the survey area, resulting in a breeding bird assemblage of 67 species.

Territories of three species listed on Annex 1 of the EU Birds Directive (Red Kite, Common Tern and Kingfisher) and territories of four species (Red Kite, Little Ringed Plover, Barn Owl and Hobby) that are included on Schedule 1 of the Wildlife and Countryside Act 1981 (as amended) were confirmed as holding (or thought to be probably/possibly holding) breeding territories within the survey area.

Thirteen species are listed as a priority species in the UK Biodiversity Action Plan and as a species of principal importance under Section 41 of the NERC Act, 12 species are included on the Birds of Conservation Concern Red list and 14 species are included on the Birds of Conservation Concern Amber list.

No species was present within the survey area in numbers of national significance, *i.e.* 1% or more of the UK population, when compared to national population estimates as given in a paper by Woodward *et al.* (2020).

The populations of Little Ringed Plover, Gadwall and Common Tern within the survey area are likely to be of **district importance**. No other species recorded in the survey area were recorded in a figure approaching 1% of the county breeding population estimates in Oxfordshire. The numbers of individuals for most species recorded were all relatively low and did not represent significant proportions (*i.e.* 1% or more) of the county populations in Oxfordshire.

The breeding assemblage of 67 species will place the value of the Site as being of up to county importance for breeding birds.

1. Introduction

1.1 Background

- 1.1.1 AECOM was instructed by Oxfordshire County Council (the client) to undertake a survey of breeding birds for the proposed Didcot Garden Town HIF (hereafter referred to as the 'Scheme'). The Preliminary Ecological Appraisal (PEA) (AECOM, 2020¹) for the Scheme, undertaken in January 2020, identified that the habitat within the Scheme boundary was suitable to support birds during the breeding season and that surveys were required to determine the presence and assemblages of protected or notable² breeding bird species within the Scheme boundary (the Site). Therefore, AECOM was instructed to undertake surveys of breeding birds within the Site and an appropriate survey zone (collectively referred to hereafter as the survey area) to record the species, distribution and numbers of breeding birds within the Site and adjacent habitat.
- 1.1.2 The information described in this report provides a complete baseline which will be used to inform the Environmental Impact Assessment (EIA) for the Scheme.

1.2 The Scheme

- 1.2.1 The Scheme is located to the west and north of Didcot, Oxfordshire, between the Milton Interchange Service Area in the west (at OS grid reference SU 483 913), and the B4015 north-east of the village of Clifton Hampden (at OS grid reference SU 548 962).
- 1.2.2 The central grid reference for the Scheme is SU 521 923.
- 1.2.3 The Scheme comprises the following four improvement sites (see Figure 1):
- A4130 Widening, which will dual the existing road between Milton Gate and the new Didcot Science Bridge, with several new junctions into adjacent proposed developments;
 - Didcot Science Bridge, a new bridge over the Great Western Railway Mainline and a new link road through the former Didcot A Power Station site, re-joining the A4130 Northern Perimeter Road north of the Purchas Road/Hawksworth roundabout;
 - Didcot to Culham River Crossing, providing a new road connecting the A4130 at Didcot with the A415 at Culham, including a bridge over the River Thames and another bridge over a private rail line, and connections to Appleford and Sutton Courtney via B4016; and
 - Clifton Hampden Bypass, a new relief road north of the village, between the A415 at Culham Science Centre and the B4015 Oxford Road, north of Clifton Hampden.

1.3 Site Descriptions

- 1.3.1 The land use within the Site is a mixture of agricultural land with an active power station site, an old power station site (Didcot A Power Station) currently undergoing redevelopment, an industrial estate, a live landfill site and a quarry. Multiple waterbodies are also present within the Site and the survey area.

¹ AECOM. (2020). Didcot Garden Town Preliminary Ecological Appraisal.

² A notable species is a species with a conservation designation, but no legal protection.

- 1.3.2 A summary description of the habitats within the Site is provided below and a more detailed description of the habitats is provided in the PEA report (AECOM, 2020¹). The Scheme layout is shown in Figure 1.

A4130 Widening

- 1.3.3 This part of the Scheme comprises a dual-carriageway from a point approximately 250 m east of Milton Interchange at the junction with Milton Gate, eastwards for approximately 1.6 km to the proposed eastern roundabouts connecting into the future development at Valley Park and the Didcot Science Bridge scheme. Dualling of the A4130 will consist of modifications to the existing single carriageway, establishment of a central reserve and provision of two additional lanes to the south. The existing single carriageway will form the eastbound carriageway towards Didcot and the newly constructed lanes will form the westbound carriageway to the A34 Milton Interchange.
- 1.3.4 A four-arm roundabout at the western end of the scheme is proposed to serve an area located immediately south-west of this roundabout, which has been subject to approved outline development proposals for Roadside Services and Facilities (planning application reference P15/V2880/O). This Backhill roundabout will also provide access to the North West of Valley Park strategic housing allocation site, to the south and east.
- 1.3.5 A new signalised T-junction is proposed approximately 600 m east of the Backhill roundabout which will provide access to the Valley Park strategic housing allocation site, which is the subject of an outline planning application P14/V2873/O, with a resolution to grant permission subject to Section 106 agreement.
- 1.3.6 A new three-arm Old A4130 roundabout is proposed 600 m east of the signalised junction. The eastern arm will be the current A4130, that is to be retained as a single carriageway, providing access into Didcot. The south-eastern arm is proposed to be an approximately 260 m single carriageway road connecting to the new Didcot Science Bridge three-arm roundabout. The Didcot Science Bridge roundabout will provide access to the new Didcot Science Bridge to the north, and Valley Park housing development to the south. Access at this location is already being secured through the outline planning application for Valley Park.
- 1.3.7 The road corridor will also include a bi-directional segregated cycleway and a footway on the southern side of the dual carriageway, as well as several formal crossing points and buffer.

Didcot Science Bridge

- 1.3.8 This section of the proposed scheme is a new north-south bridge from the proposed Didcot Science Bridge roundabout, over the existing A4130, the Great Western Railway Mainline, and Milton Road, into the former Didcot A Power Station site. The proposed Didcot Science Bridge Link Road (SBLR) will connect the bridge with the A4130 Northern Perimeter Road north of the Purchas Road/Hawksworth roundabout, close to the existing Southmead Industrial Estate.
- 1.3.9 Planning permission (P15/S1880/O and P15/V1304/O) has been granted for a mixed-use development in the power station site and this includes the reservation of land for the SBLR and Didcot Science Bridge. There will be various embankments associated with the road bridge approaches, and they will vary in width. The road bridge will be approximately 16 m in width, including a single carriageway, a bi-directional segregated cycleway and a footway on one side of the road.

- 1.3.10 The SBLR will be a single carriageway, with segregated footways and bi-directional cycleways on both sides of the road for the majority of its length. Various accesses are planned off the road alignment for the proposed development in the power station site (P15/S1880/O and P15/V1304/O). Other works required include the diversion of a watercourse which will cross underneath the new road in a culvert, and provision of formal Non-Motorised User (NMU) crossings, including a toucan crossing where a National Cycle Route crosses the road alignment.

Didcot to Culham River Crossing

- 1.3.11 This section of the Scheme will provide a new 3.6 km single carriageway link road west of the Cherwell Valley railway line and NMU facilities between Didcot and Culham. It will extend north from the A4130 Collett roundabout in Didcot to the A415 Abingdon Road west of Culham Science Centre.
- 1.3.12 An improved and enlarged four-arm A4130 Collett roundabout will be provided. This will connect with the Didcot Science Bridge scheme to the west, the Didcot to Culham Link Road to the north, Southmead Industrial Estate to the south and to the existing A4130 to the east.
- 1.3.13 Agricultural land, private residential properties, a pallet and wood recycling centre, Sutton Courtenay landfill, and Hanson aggregate operations all lay north of Collett roundabout. A Local Development Order is being prepared to enable this agricultural area to become an employment site called D-Tech, in this “Didcot Growth Accelerator” Enterprise Zone.
- 1.3.14 North of Collett roundabout to the southern edge of Sutton Courtenay Landfill, the new single carriageway road will be approximately 20 m wide with verges, hard strips, and segregated footways and bi-directional cycleways on both sides. Two accesses, one on either side of the proposed road, will be provided to maintain access to the adjacent agricultural land, private residential properties and businesses.
- 1.3.15 The road will extend north along the east edge of Sutton Courtenay Landfill. In this area on the west side of the road a 3.0 m shared use bridleway is provided with the segregated footways and bi-directional cycleways continuing on the east side. On the west side of the road a new priority junction and access road will be provided to Sutton Courtenay Landfill (operated by FCC Environment), and Hanson Aggregates and Appleford Railway Sidings (operated by Hanson). This will replace the existing Portway Road access further north.
- 1.3.16 The road extends north to Appleford railway sidings passing along the eastern boundary of a large surface water management pond. The Cherwell Valley Line and Appleford Level Crossing is located to the east of the proposed road. Appleford Sidings bridge will be provided to bridge the road over the railway sidings and connect the north and south approach embankments.
- 1.3.17 The road will traverse 90 Acre Field, an area of restored historic landfill, and link to the B4016 to the west of Appleford. A priority T-junction with a ghost island right turn lane will be provided at this location. Sutton Courtenay roundabout will be provided to the north-west with a severed section of the B4016 retained to be a footway cycleway. Sutton Courtenay roundabout will be an at grade, three-arm roundabout providing access to the crossing over the River Thames whilst maintaining links between Appleford, Sutton Courtenay and the surrounding areas.
- 1.3.18 Extending north from Sutton Courtenay roundabout, a 336 m approach viaduct will be provided to cross the River Thames flood plain with a 155 m bridge provided to

span over the River Thames. The River Thames is navigable at this location the bridge height has been designed to accommodate river traffic.

- 1.3.19 North of the River Thames, the new link road will continue north through existing agricultural land towards A415 where a new at grade four-arm roundabout will be constructed to connect with the A415 and a new development to the north which is an allocated site in the Local Plan.

Clifton Hampden Bypass

- 1.3.20 The Clifton Hampden Bypass will re-route traffic on the A415 around the village of Clifton Hampden, which currently experiences a large amount of through traffic as people travel between the A415 to A4074 northwest of the village.
- 1.3.21 The link road will provide a bypass northwest of Clifton Hampden village and will be approximately 2.2 km long. The new road will be a single carriageway with adjacent hard strips, grass verges, and a shared-use cycleway / footway. The bypass will be aligned in a south-west to north-east direction and will be a single carriageway, approximately 9.3 m in width including hard strips.
- 1.3.22 The proposed works also include the construction of a large four-arm roundabout at the western end of the Scheme, providing access to the SODC Local Plan allocated housing site, a railway station and Leda Properties owned farmland / businesses north of Culham Science Centre (CSC) coming off the northern arm, and CSC on the north-east arm. A new T- junction with a ghost island right turn lane connecting the existing B4015 Oxford Road is proposed at the eastern extent of the Scheme.
- 1.3.23 The current alignment of the A415 will be realigned north into the proposed bypass, with the existing A415 west of this point as a “no through road” to serve existing residences. All roundabout exits will include one lane, except the eastern bypass arm which will have two lanes. The roundabout will have a segregated left turn lane from the eastern bypass arm to the western A415 arm.
- 1.3.24 Station Road will be realigned and will join with a new entrance to the industrial properties located northwest of the roundabout. The existing main access into the CSC will be converted into a shared use footway / cycleway. The northeast roundabout arm will provide access to CSC via the main gate, and a stub towards Perimeter Road for a potential future connection to be delivered by CSC.
- 1.3.25 The A415 connection road east of the roundabout will provide access from the bypass to the existing A415 and Clifton Hampden.
- 1.3.26 Along the bypass, four access points will be included on the south side of the road; one will link to the existing alignment of the A415 (as described); one to a Thames Water sewage treatment works; and one to an existing farm track. The bypass will tie-in with the current alignment of the B4015 Oxford Road (east) and a T-junction with a ghost island right turn will be included, to provide access to the current alignment of the B4015 Oxford Road (south-west).
- 1.3.27 On the north side of the road, two accesses will be created; one will be a new second access into the CSC, the other will link with an existing farm track.

1.4 Scope of the Report

- 1.4.1 The objective of the breeding bird survey, reported in this document, is to determine the presence and assemblages of breeding bird species within the survey area to determine any potential impacts of the Scheme on breeding birds.

1.4.2 This report includes the following information:

- relevant legislation and policy;
- methods for desk and field-based assessments (undertaken in 2019 and 2020);
- limitations to the surveys undertaken and any assumptions made as a result of incomplete data;
- survey results;
- the approach for determining the nature conservation importance of breeding bird populations recorded during the assessments; and
- conclusions.

2. Relevant Legislation and Policy

2.1 Legislation

Wildlife and Countryside Act

- 2.1.1 The legislative provisions for the protection of wild birds in the UK are contained primarily in Sections 1-7 of the Wildlife and Countryside Act (WCA) 1981 (as amended³). Under the WCA, a wild bird is defined as any bird of a species that occurs in a wild state as a resident or a visitor to the European Territory of any member state.
- 2.1.2 When breeding, all birds, their nest, eggs and nestlings are afforded protection under the Wildlife and Countryside Act 1981, as updated by the 'Countryside Right of Way Act 2000'. Therefore, during the bird breeding season (typically March-August inclusive) it is an offence to:
- intentionally kill, injure or take any wild bird;
 - intentionally take, damage or destroy the nest of any wild bird while it is in use or being built; and
 - intentionally take or destroy the eggs of any wild bird.
- 2.1.3 Additionally, special penalties exist for offences related to species listed on Schedule 1 of the Wildlife and Countryside Act, 1981 (as amended), for which there are additional offences for disturbing these birds at their nest, or their dependent young. Schedule 1 birds cannot be intentionally or recklessly disturbed when nesting and there are increased penalties for doing so. No licences are available for disturbance during a development even in circumstances where that development is fully authorised by consents such as a valid planning permission.

Directive of the Conservation of Wild Birds

- 2.1.4 Additionally, a number of bird species recorded within the UK (including those that are resident, overwintering and migratory) are protected under European legislation. The Directive of the Conservation of Wild Birds (EU Birds Directive) (EC, 2009⁴) lists species, or sub-species, of birds in Annex 1 which are:
- in danger of extinction;
 - are rare, or have restricted local distribution;
 - are vulnerable to specific changes in their habitat; or
 - require particular attention for reasons of the specific nature of habitat.
- 2.1.5 These species are afforded enhanced legal protection and EU member states have a responsibility to maintain the populations of these species at a level that corresponds to their ecological, scientific and cultural requirements (Article 2). This Directive is transposed into English law through the Conservation of Habitats and Species Regulations 2017 (as amended)⁵.
- 2.1.6 Species listed on Annex 1 of the Directive are those for which the UK Government are also required to take special measures, including the designation of Special Protection Areas, to ensure the survival and reproduction of these species throughout

³ Anon. (1981). The Wildlife & Countryside Act. HMSO, London.

⁴ EC (2009) Directive 2009/147/EC of the European Parliament and of the Council of 30 November 2009 on the conservation of wild birds (codified version). EC, Brussels.

⁵ As such, the requirements of the EC Birds Directive (2009/147/EC) are still applicable despite the UK no longer being a member state of the European Union

their area of distribution. These sites are then automatically included within the Natura 2000, which is a network of core breeding and resting sites that are protected for rare and threatened species.

Priority Species

- 2.1.7 In addition to the above legislation, 49 bird species are listed as being Species of Principal Importance for conservation in England under Section 41 of the Natural Environment and Rural Communities (NERC) Act 2006⁶. These species are of material consideration during the planning process. Section 41 of the NERC Act 2006 requires the Secretary of State to publish a list of habitats and species which are of Principal Importance for the conservation of biodiversity in England. The list has been drawn up in consultation with Natural England, as required by the Act. The Section 41 list is used to guide decision-makers such as public bodies (including local and regional authorities) in implementing their duty under Section 40 of the NERC Act; to have regard to the conservation of biodiversity in England when carrying out their normal functions.
- 2.1.8 The Joint Nature Conservation Committee (JNCC) UK Biodiversity Action Plan (UKBAP) (JNCC, 1994⁷), was launched in 1994 and identified UK BAP priority species of conservation concern that are the most threatened in the UK and requiring action under the UKBAP and for which action plans have been published. However, the work undertaken for the UKBAP is now focussed at a country level, rather than UK level, and the UKBAP has subsequently been succeeded by the UK Post-2010 Biodiversity Framework (July 2012) (JNCC, 2012⁸). However, the UK list of priority species remains an important reference source and has been used to help draw up statutory lists of priority species in England, Scotland, Wales and Northern Ireland. For the purpose of this assessment, the UK BAP is still used as one of the criteria to assist in assigning national value to any given ecological receptor.

2.2 Planning Policy

- 2.2.1 National and local planning policy relevant to nature conservation is provided in detail in the PEA report for the Scheme (AECOM, 2020¹).

2.3 Local Biodiversity Action Plan Species

- 2.3.1 No specific species action plans are listed within the Biodiversity Action Plan, instead, a list of all UK BAP priority species found within Oxfordshire is provided on the ONCF website (ONCF, 2010^{9,10}).

2.4 Birds of Conservation Concern

- 2.4.1 The Birds of Conservation Concern (BoCC) (Eaton *et al.* 2015¹¹) is an assessment of the conservation status of all regularly occurring British birds. The lists (Red, Amber and Green), that indicate the level of conservation importance for each species, are derived from quantitative assessments from standardised criteria. The assessment

⁶ Anon. (2006). The Natural Environment and Rural Communities Act. HMSO, London.

⁷ JNCC. (1994) UK Biodiversity Action Plan (UKBAP). Available at: <http://jncc.defra.gov.uk/page-5155> [Accessed April 2020].

⁸ JNCC. (2012) UK Post-2010 Biodiversity Framework. Available at: <http://jncc.defra.gov.uk/page-6189> [Accessed April 2020].

⁹ Oxfordshire Nature Conservation Forum. (2010a). Oxfordshire's Biodiversity Action Plan and Conservation Target Areas. Available at:

<https://www2.oxfordshire.gov.uk/cms/sites/default/files/folders/documents/environmentandplanning/countryside/naturalenvironment/BAPnewsletterFINAL.pdf> [Accessed April 2020]

¹⁰ Oxfordshire Nature Conservation Forum. (2010b). Biodiversity. Available at: <http://www.oncf.org.uk/biodiversity/biodiversity.html> [Accessed April 2020].

¹¹ Eaton, M., Aebischer, N., Brown, A., Hearn, R., Lock, L., Musgrove A., Noble D., Stroud, D. and Gregory, R. (2015). *Birds of Conservation Concern 4. The population status of birds in the United Kingdom, Channel Islands and Isle of Man*. British Birds 108: 708-746.

is based on the most up-to-date evidence available and criteria include conservation status at global and European levels and, within the UK: historical decline, trends in population and range, rarity, localised distribution and international importance. The lists are drawn together by the UKs leading bird conservation organisations, including the Royal Society for the Protection of Birds (RSPB) and British Trust for Ornithology (BTO).

2.4.2 The criteria for birds being included in the BoCC lists are as follows.

Red List:

- globally threatened;
- historical population decline in UK during 1800–1995; and
- severe (at least 50%) decline in UK breeding population over last 25 years, or longer-term period (the entire period used for assessments since the first BoCC review, starting in 1969). Severe (at least 50%) contraction of UK breeding range over last 25 years, or the longer-term period.

Amber List:

- species with unfavourable conservation status in Europe (SPEC = Species of European Conservation Concern);
- historical population decline during 1800–1995, but recovering; population size has more than doubled over last 25 years;
- moderate (25-49%) decline in UK breeding population over last 25 years, or the longer-term period;
- moderate (25-49%) contraction of UK breeding range over last 25 years, or the longer-term period;
- moderate (25-49%) decline in UK non-breeding population over last 25 years, or the longer-term period;
- rare breeder; 1–300 breeding pairs in UK;
- rare non-breeders; less than 900 individuals;
- localised; at least 50% of UK breeding or non-breeding population in 10 or fewer sites, but not applied to rare breeders or non-breeders; and
- internationally important; at least 20% of European breeding or non-breeding population in UK (NW European and East Atlantic Flyway populations used for non-breeding wildfowl and waders respectively).

Green List:

- species that occur regularly in the UK but do not qualify under any of the above criteria.

2.4.3 Although the BoCC lists confer no legal status in themselves, they are useful in evaluating the conservation significance of bird assemblages and for assessing the potential significance of impacts and informing appropriate levels of mitigation with respect to bird populations.

3. Methods

3.1 Desk Study

- 3.1.1 A desk study was undertaken in December 2019 through Thames Valley Environmental Records Centre (TVERC) to obtain records of protected and notable bird species within a 2 km radius of the Site and from within the last ten years of the request date. as any records older than ten years are unlikely to be still representative of bird species in the local area.
- 3.1.2 Aerial photography and 1:2,500 Ordnance Survey mapping were examined to appraise habitat information outside of the Site to determine whether the habitat within the Zone of Influence¹² could support species included on WCA Schedule 1, including Barn Owl, Red Kite, Peregrine or Hobby. Such areas include areas of mature trees and farm buildings for Barn Owl, areas of woodland for Red Kite, industrial areas for Peregrine and areas of woodland and mature hedgerows for Hobby. This desk study was then used to refine survey areas for such species.

3.2 Field Survey

Survey Area

- 3.2.1 The survey area included habitat within the Site and a zone of 100 m around it.
- 3.2.2 Standardised survey zones for assessing the impacts of development on bird populations do not exist, however, the survey area used provides information on the breeding birds within the area immediately surrounding the Site and includes areas contiguous with the Site, where birds may potentially be adversely affected.
- 3.2.3 Depending on the sensitivity of the species, birds occurring outside of the survey area may also be adversely affected. However, the survey area is sufficient to determine the likely impacts of the Scheme on the majority of breeding bird species occurring or likely to occur in the area.
- 3.2.4 In consideration of the potential presence of breeding bird species listed on Schedule 1 of the Wildlife and Countryside Act (1981, as amended) within the wider area, the survey area was extended out to 500 m from the Site (where access allowed) to record any such species (including Barn Owl (*Tyto alba*), Red Kite (*Milvus milvus*), Peregrine (*Falco peregrinus*) and Hobby (*Falco subbuteo*)).

Territory Mapping Survey – General Breeding Bird Assemblage

- 3.2.5 The survey area was surveyed for breeding birds using a standard territory mapping methodology as detailed in Bibby *et al.* (2000¹³) and Gilbert *et al.* (1998¹⁴). This method is based on the principle that many species during the breeding season are territorial. This is found particularly amongst passerines, where territories are often marked by conspicuous song, display and periodic disputes with neighbouring individuals.
- 3.2.6 Survey routes were walked by surveyors using suitable optical equipment to observe bird behaviour. Regular stopping points were included along the routes to record any

¹² The area surrounding the Scheme where breeding birds could be impacted by the Scheme.

¹³ Bibby, C.J., Burgess, N.D., Hill, D.A. and Mustoe, S.H. (2000). *Bird Census Techniques: 2nd edition*. Academic Press, London.

¹⁴ Gilbert, G., Gibbons, D.W. and Evans, J. (1998). *Bird Monitoring Methods: A manual of techniques for key species*. RSPB/BTO/JNCC/WWT/ITE/The Seabird Group. RSPB/BTO, Sandy, Beds.

species that may be passing through the survey area. Survey routes were mapped, and the direction walked alternated on each visit, to ensure that all areas were covered at various times of day across the duration of the survey. Surveys were undertaken during a range of daylight hours, between sunrise and sunset.

- 3.2.7 Survey routes followed the length of all hedgerows, fence-lines and field margins (including paths, tracks and roads). Deviations into areas of set-aside, stubble fields, scrub, woodland and other uncultivated habitats were made, where possible. The routes did not include ploughed or cultivated fields, due to the possibility of trampling and damaging crops. Fields containing livestock were avoided for safety reasons.
- 3.2.8 On each visit, the route was walked at a slow pace with start and finish times noted. All birds seen and heard were recorded directly onto a Samsung tablet using Collector software, with a 1:10,000 scale Ordnance Survey base map of the survey area. Registrations of birds were recorded using standard British Trust for Ornithology (BTO) two letter species codes.
- 3.2.9 All bird species were recorded and mapped across the whole survey area. The expected outcome from the surveys is that mapped registrations fall into clusters, approximately coinciding with territories. A cluster is generally a spatially distinct group of registrations that represent the activity of not more than one pair. Ideally, clusters include registrations of territorial behaviour across all visits and are clearly demarcated from adjacent clusters by simultaneous recording of neighbouring birds. Where a species has closely packed territories, the mapping of simultaneously singing birds becomes essential. Territory boundaries are assumed to be between such birds.
- 3.2.10 Surveys of the general breeding bird assemblage were undertaken monthly between April and June 2020, with a total of six survey visits. Each survey was undertaken during appropriate weather conditions for survey and avoided, where possible, on days with adverse weather conditions such as heavy rain or strong winds as birds may be harder to detect in such conditions. The date and weather conditions for each survey are presented below in Table 3.1.

Table 3-1: Survey dates and weather conditions for general breeding bird assemblage

Visit	Dates	Weather Conditions
1	1 st April 2020	Dry, 10-30% Cloud, Wind F1, -3°C
2	14 th April 2020	Dry, 40-50% Cloud, Wind F1, 3°C
3	27 th April 2020	Dry, 60-90% Cloud, Wind F1, 8°C
4	13 th May 2020	Dry, 60–90% Cloud, Wind F2, 6°C
5	28 th May 2020	Dry, No Cloud, Wind F1, 11°C
6	10 th June 2020	Recent rain, Overcast, Wind F1, 11°C
Notes on Table 3.1: Wind speed is shown using the Beaufort scale, which is an empirical measure of force F0-12 that relates wind speed to observed conditions.		

- 3.2.11 Territory mapping methods produce analysis maps of non-overlapping ellipses encircling clusters of records thought to relate to separate pairs of breeding birds. These ellipses may not show the entire extent of the pairs' actual breeding territory which may be significantly larger; however, they are likely to show those areas in which the pair is most active.

- 3.2.12 On completion of the six surveys, analysis maps were produced for each species, consisting of all registrations recorded during surveys. From these species' maps, the number of territories was calculated by identifying the number of clusters present.
- 3.2.13 For late-arriving migrants, e.g. Spotted Flycatcher *Muscicapa striata*, for which fewer potential contacts are possible, only one registration is required to form a territory cluster. Several species are not territorial and are dealt with appropriately, e.g. Linnet *Linaria cannabina*, where data represent aggregations or loose colonies.
- 3.2.14 Standard registration mapping techniques were also used to record non-breeding species.
- 3.2.15 The following definitions were used to identify the breeding territory status of each species recorded:
- Confirmed: includes species for which territories were positively identified as a result of the number of registrations recorded; the location of an active nest; or the presence of recently fledged young / downy young;
 - Probable: includes a species pair observed in suitable nesting habitat during surveys; or agitated behaviour / anxiety calls from adults (suggesting the presence of a nest or young nearby). Behaviour was observed on insufficient occasions to confirm the presence of a territory;
 - Possible: includes species observed during surveys in suitable nesting habitat, or a singing male present (or breeding calls heard) in suitable breeding habitat; or
 - Non-breeding: species-specific information was used to determine fly-over species, or species suspected to be summering non-breeder.

Species-specific Surveys

Barn Owl

- 3.2.16 The field survey to determine nesting and roosting sites for Barn Owl was undertaken based on the three key stages, as detailed by Shawyer 'Barn Owl *Tyto alba* Survey Methodology and Techniques for use in Ecological Assessment' (2011)¹⁵.
- 3.2.17 These three stages were:
- Stage 1: on-site scoping survey – undertaken in March and August 2020 to identify and record habitat features of the landscape which are broadly suited to Barn Owl;
 - Stage 2: investigative field survey – undertaken in March and August 2020 to determine which of the habitat features identified in the Stage 1 survey offer potential nest sites, roost sites and habitats for foraging and movement; and
 - Stage 3: nest site verification survey – undertaken in March and August 2020 to confirm which of the potential nest sites identified in the stage 2 survey is currently used by Barn Owl for breeding.

Stage 1: On-site Scoping Survey

- 3.2.18 The Stage 1 survey involved a walkover of the survey area (see section 3.2.4 of this report) on 17th, 18th and 19th March 2020, during daylight hours, to broadly record and assess suitability of features of potential value to Barn Owl, such as built structures,

¹⁵ Shawyer, C.R. (2011) Barn Owl *Tyto alba* Survey Methodology and Techniques for use in Ecological Assessment: Developing Best Practice in Survey and Reporting. IEEM, Winchester.

mature trees and other habitats that could offer potential roosting or nesting sites for Barn Owl.

- 3.2.19 Mature trees with a trunk diameter of sufficient girth and with a cavity of sufficient quality to support Barn Owl (e.g. provide a roosting or nesting platform), were recorded. However, whilst a number of trees were potential candidates for recording, only mature trees that stand prominently in fields, hedgerows or are on / near woodland edge were considered during the Stage 1 survey as the susceptibility of trees to decay (and hence reduce their suitability as a roosting / nesting site) varies with tree species and age. As a reference, the trunk diameters detailed by Shawyer (2011)¹⁶ were used as a guide to record trees during the Stage 1 survey. These were:
- Ash *Fraxinus excelsior*, Sycamore *Acer pseudoplatanus* and Crack Willow *Salix fragilis*: 0.5 m diameter or more (>80 years old);
 - Horse Chestnut *Aesculus hippocastanum* and Beech *Fagus sylvatica*, 0.75 m diameter or more (>150 years); and
 - Oak *Quercus robur*, 1.5 m diameter or more (>250 years).
- 3.2.20 Any other trees with a large hole or cavity and with no access to cavities from ground predators were also recorded.
- 3.2.21 During the Stage 1 survey, all surveys were undertaken from ground level and no trees were climbed.
- 3.2.22 Buildings with features that could support roosting or breeding Barn Owl, such as agricultural buildings and structures with access to the interior were recorded, along with any signs of Barn Owl (e.g. pellets, droppings, sightings).
- 3.2.23 Any Barn Owl nest boxes within the survey area were also recorded.

Stage 2: Investigative field survey and Stage 3: Nest site verification

- 3.2.24 Following the initial scoping survey, a Stage 2 and 3 survey was undertaken between 10th and 11th August 2020 of each potential Barn Owl site, based on the results of the Stage 1 survey (as detailed above).
- 3.2.25 The Stage 2 survey involved a walkover of the survey area, focusing on features of interest to Barn Owl that were identified during the Stage 1 survey. The objective of the Stage 2 surveys was to inspect, from ground level, built structures and mature trees, originally recorded in the Stage 1 scoping survey, to determine if they were in use, or potentially used, by Barn Owl. The Stage 3 survey involved a detailed inspection of all features of interest, identified during the Stage 2 surveys. Where the presence of an active nest could not be confirmed at ground level, a ladder (where required) was used to inspect any tree cavities or buildings.
- 3.2.26 The Stage 2 and Stage 3 surveys were undertaken by an appropriately licenced ecologist, holding a CL29 class licence, which permits registered persons to disturb nesting Barn Owl by observation in the course of undertaking presence or likely absence surveys, nest monitoring and, or to monitor the effectiveness of conservation efforts.
- 3.2.27 Signs of Barn Owl, that indicate occupation, or potential occupation, typically include:
- presence of adult birds,

¹⁶ Shawyer, C.R. (2011) Barn Owl *Tyto alba* Survey Methodology and Techniques for use in Ecological Assessment: Developing Best Practice in Survey and Reporting. IEEM, Winchester.

- nests, eggs, or young (during the breeding season);
- pellets;
- white ‘splashing’ caused by droppings;
- feathers; and, or
- small mammal remains.

3.2.28 The following criteria was set against any presence or absence of Barn Owl:

- Site potentiality: the tree or building is or is not, or, was or was never a potential roost or nest site. The suitability will be recorded as none, low, medium or high.
- No evidence: no evidence of Barn Owl was found but a clear statement of the probability that evidence has been covered, lost or removed is made.
- Old roost site: evidence of roosting was found but no sign of occupation within the last two years. No evidence of resting, past or present.
- Recent roost site: evidence of roosting within the past two years was found but no evidence of nesting past or present.
- Current pair roosting: evidence of two Barn Owls roosting within the past month was found but no evidence of nesting, past or present.
- Nest site: evidence that Barn Owls are currently nesting or have nested at some time in the past was found.

3.2.29 Where signs of Barn Owl were found, these were recorded directly onto a Samsung tablet using Collector software, with a 1:10,000 scale Ordnance Survey base map of the survey area.

Survey of Potential Foraging and Dispersal Habitat

3.2.30 Suitable Barn Owl foraging and dispersing habitat, as defined by Shawyer (2011⁶), was identified across the survey area by reviewing the Phase One Habitat map within the Preliminary Ecological Appraisal (AECOM, 2019¹). Suitable habitat for Barn Owl includes permanent unimproved or semi-improved grassland, grassland margins, woodland edge etc.

3.2.31 The evaluation of habitat of potential importance to Barn Owl was used to indicate where the bisection of prime foraging habitat by the Scheme will predispose this location as a future traffic accident ‘blackspot’ for Barn Owls and where mitigation may be required to prevent this.

Other WCA Schedule 1 Species

3.2.32 Walkover surveys to determine the presence, or absence, of species listed on Schedule 1 of the WCA, 1981 (as amended) were undertaken within 500 m of the Site and were based on the territory mapping methodology, as detailed in Gilbert *et al.*, ‘Bird Monitoring Methods’ (1998)¹³ and Bibby *et al.*, ‘Bird Census Techniques’ (2000)¹² and amended accordingly to concentrate survey effort within peak breeding activity times of certain species known to be in the surrounding area (from the desk study), such as Red Kite and Peregrine.

3.2.33 The habitat within 500 m of the Site was walked at a slow pace and was surveyed using suitable optical equipment to observe bird behaviour. Surveys were undertaken in the morning, finishing before midday.

3.2.34 Surveys for species listed on Schedule 1 of the WCA were undertaken between 17th March and 10th August 2020 and were combined with surveys for the general breeding bird assemblage (see above). However, five additional survey visits were also undertaken (see Table 3.2). Each survey was undertaken during appropriate weather conditions for survey and avoided, where possible, adverse weather conditions such as heavy rain or strong winds as birds may be harder to detect in such conditions. The survey visit dates and weather conditions are detailed in Table 3.2.

Table 3-2: Survey dates and weather conditions for WCA Schedule 1 species

Visit	Dates	Weather Conditions
1	17 th March 2020	Dry, 60-90% Cloud, Wind F3, 11°C
2	18 th March 2020	Dry, Overcast, Wind F3, 12°C
3	19 th March 2020	Drizzle, Overcast, Wind F3, 6°C
4	10 th August 2020	Dry, 10-30% Cloud, Wind F2, 22°C
5	11 th August 2020	Dry, No Cloud, Wind F1, 27°C
Notes on Table 3.1: Wind speed is shown using the Beaufort scale, which is an empirical measure of force F0-12 that relates wind speed to observed conditions.		

3.2.35 All observations of WCA Schedule 1 species that were seen and heard, including confirmed or potential nesting sites, were recorded directly onto a Samsung tablet using Collector software, with a 1:10,000 scale Ordnance Survey base map of the survey area. Registrations were recorded using standard British Trust for Ornithology (BTO) two letter species code. Specific codes were used to denote calling, movements between areas, flight, carrying food, nest building, aggressive encounters and other behaviour indicative of breeding and / or potential breeding.

3.3 Assessment of Ornithological Importance

3.3.1 The assessment of the ornithological importance of the survey area during the breeding season was made by evaluating any species afforded special statutory protection or those included on one, or more, of the lists of species of conservation interest, as detailed in Section 2 of this report. These include:

- species listed on Annex 1 of the EU Birds Directive;
- species listed on Schedule 1 of the Wildlife and Countryside Act, 1981 (as amended);
- priority bird species in the UK; and
- species included in the Birds of Conservation Concern (BoCC) Red and Amber Lists (Eaton *et al.* 2015¹⁷).

Species Abundance

3.3.2 In addition to evaluating a site based on its populations of breeding birds in relation to legal status, rarity and conservation value, consideration is given to the value of the survey area for the population of individual species that it supports. This can be done by comparing the population present within the survey area with the national and county breeding population for certain species. National estimates for breeding birds are published in Population estimates of birds in Great Britain and the United

¹⁷ Eaton, M., Aebischer, N., Brown, A., Hearn, R., Lock, L., Musgrove A., Noble D., Stroud, D. and Gregory, R. (2015). *Birds of Conservation Concern 4. The population status of birds in the United Kingdom, Channel Islands and Isle of Man*. British Birds 108: 708-746.

Kingdom (Woodward *et al.*, 2020)¹⁸. The British Trust for Ornithology (BTO) Bird Atlas 2007-2011 (Balmer *et al.*, 2013)¹⁹ was also reviewed for species information on a national level.

- 3.3.3 Current county-level estimates on the breeding bird populations for most species in Oxfordshire were sourced from county avifauna reports, where this information is available.

Species Diversity

- 3.3.4 The number of species recorded in an area is a simple measure of diversity that can indicate its importance at each season of the year. Table 3.3 shows the breeding species diversity criteria as outlined in 'A method for assessing the ornithological interest of sites for conservation' (Fuller, 1970)²⁰, which provides a method for assessing the ornithological interest of sites for conservation.

Table 3-3: Breeding Species Diversity Criteria (Fuller, 1970)

Local	County	Regional	National
25-49	50-69	70-84	85+

- 3.3.5 It should be noted that Fuller's analysis was developed in the 1970s and, since then, species diversity has declined significantly. As a result, Fuller's thresholds are, in most circumstances, too high for today's breeding bird populations. However, it is not considered that the differences will be significant to increase the geographical scale at which the assemblages are considered to have value.
- 3.3.6 The Joint Nature Conservation Committee Guidelines for selection of Biological Sites of Special Scientific Interest (SSSI) (Drewitt *et al.* 2019²¹) provides a scoring system for habitats based on the breeding presence of certain key species that are characteristic of the habitat and give a threshold value for SSSI selection based on the score.
- 3.3.7 Local Wildlife Sites (LWS) (or County Wildlife Sites (CWS)) are among the most important places for wildlife in Oxfordshire, together with legally protected land such as Sites of Special Scientific Interest (SSSIs) and Conservation Target Areas (CTAs).
- 3.3.8 In Oxfordshire, an individual CWS can be selected for birds if it meets the guidelines within the Criteria for the Selection of Local Wildlife Sites in Berkshire, Buckinghamshire and Oxfordshire (2009)²². Criterion 5.7.Ai. of the selection criteria details that any site that supports the breeding of any notable species (as detailed below in section 3.3.9) within the county may be considered for Wildlife Site status. These species that are rare in the area and are colonial or faithful to specific breeding sites over long periods. They are also listed under one or more of these headings:

¹⁸ Woodward, I., Aebischer, N., Burnell, D., Eaton, M., Frost, T., Hall, C., Stroud, D.A. & Noble, D.(2020). Population estimates of birds in Great Britain and the United Kingdom. *British Birds* 113: 69–104

¹⁹ Balmer, D., Gillings, S., Caffrey, B., Swann, B., Downie, I. and Fuller, R. (2013). Bird Atlas 2007-2011. Available at <https://www.bto.org/research-data-services/publications/bto-books-and-guides/2013/bird-atlas-2007-11-breeding-and> [Accessed April 2020].

²⁰ Fuller (1970). A method for assessing the ornithological interest of sites for conservation. *Biological Conservation*. 17(3):229-23

²¹ Drewitt, A.L., Whitehead, S. and Cohe, S., Guidelines for the Selection of Biological SSSIs, Part 2. Detailed Guidelines for Habitats and Species Groups. ES Chapter 17: Birds, available at http://jncc.defra.gov.uk/pdf/SSSI_Chptr17_Birds2015June.pdf, accessed August 2020.

²² BMERC. (2009) Criteria for the Selection of Local Wildlife Sites in Berkshire, Buckinghamshire and Oxfordshire. Buckinghamshire and Milton Keynes Environmental Records Centre. [Available at: <http://www.tverc.org/cms/sites/tverc/files/LWS%20criteria%20Nov%2009.pdf>]

- threatened in Europe (ET): defined as those birds listed in Annex 1 of the European Birds Directive;
- Conservation Concern (CC): defined as those birds having Red-listed status in Birds of Conservation Concern;
- legally protected (WCA): defined as those birds listed in Schedule 1 of the Wildlife & Countryside Act; and
- County Rare or County Scarce (CR, CS): defined as:
 - County Rare = breeds in 5 tetrads or fewer.
 - County Scarce = breeds in between 6 and 15 tetrads.

3.3.9 The notable breeding species are:

- Little Egret (*Egretta garzetta*);
- Grey Heron (*Ardea cinerea*);
- Honey Buzzard *Pernis apivorus*);
- Common Tern (*Sterna hirundo*);
- Sand Martin (*Riparia riparia*);
- Nightjar (*Caprimulgus europaeus*);
- Lesser spotted woodpecker (*Dryobates minor*); and
- Woodlark (*Lullula arborea*).

3.3.10 Criterion 5.7.B of the CWS criteria details sites which support a significant assemblage of birds associated with a habitat present on the site, applying a threshold to each habitat for the species that each habitat holds, based on a scoring system. A site within which the habitat (with relevance to the habitat within the survey area) normally supports a range of breeding birds with a value equal to or exceeding the following indices (qualifying species and scores are listed in the tables below):

- Lowland open waters and margins: index threshold 47;
- Lowland scrub: index threshold 16.5; or
- Lowland woodland: index threshold 52.

Importance of the Breeding Bird Population

3.3.11 To support a focussed assessment of the population of breeding birds within the Site, their biodiversity value was defined with reference to the geographical level at which it matters. The frames of reference used in this report were made using the values presented in the 'Guidelines for Ecological Impact Assessment in the United Kingdom: Terrestrial, Freshwater, Coastal and Marine' (CIEEM, 2018²³ (hereafter referred to as the CIEEM Guidelines); and professional judgement.

3.3.12 The CIEEM guidelines uses a framework, linked to a geographical scale at which the receptor has been valued (*i.e.* international, national, regional, county, local or site) and this method represents best practice guidance. These assessment criteria set out in Table 3.3, have been used in conjunction with species rarity, abundance and diversity within the survey area to assess the biodiversity importance of the breeding bird populations recorded during the field surveys.

²³ CIEEM. (2018). Guidelines for Ecological Impact Assessment in the United Kingdom: Terrestrial, Freshwater.

Table 3-4: Importance of Ornithological Features

Importance of Ornithological Features	Descriptors and Examples of Criteria
International or European	<p>Resident or regularly occurring populations of species which may be considered of value at an International or European level¹ where:</p> <ul style="list-style-type: none"> the loss of these populations will adversely affect the conservation status or distribution of the species at this geographic scale; the population forms a critical part² of a wider population at this scale; or the species is at a critical phase³ of its life cycle at this scale.
UK or National	<p>Areas of key or priority species identified in the UK Post-2010 Biodiversity Framework <i>i.e.</i> UK Biodiversity Action Plan (BAP), including those published in accordance with Section 41 of the Natural Environment and Rural Communities Act (2006) and those considered to be of principal importance for the conservation of biodiversity.</p> <p>Resident or regularly occurring populations of species which may be considered of value at a UK or a national level⁴ where:</p> <p>the loss of these populations will adversely affect the conservation status or distribution of the species at this geographic scale;</p> <p>the population forms a critical part of a wider population at this scale; or</p> <p>the species is at a critical phase of its life cycle at this scale.</p>
Regional	<p>Populations of species of value at a regional level (<i>i.e.</i> South East England). Resident or regularly occurring populations of species which may be considered of value at a regional level⁵ where:</p> <p>the loss of these populations will adversely affect the conservation status or distribution of the species at this geographic scale;</p> <p>the population forms a critical part of a wider population at this scale; or</p> <p>the species is at a critical phase of its life cycle at this scale.</p>
County or Unitary Authority or District	<p>Populations of species of value at a County (<i>i.e.</i> Oxfordshire) level or District (<i>i.e.</i> South Oxfordshire).</p> <p>Resident or regularly occurring populations of species which may be considered of value at a County (or District)⁶ level where:</p> <p>the loss of these populations will adversely affect the conservation status or distribution of the species at this geographic scale;</p> <p>the population forms a critical part of a wider population at this scale; or,</p> <p>the species is at a critical phase of its life cycle at this scale.</p>
Local	<p>Species populations of value in a local (<i>i.e.</i> within ~ 2 km of the site) context. Populations and, or communities of species considered to appreciably enrich the habitat resource within the local context (such as veteran trees), including features of value for migration, dispersal or genetic exchange.</p>
Site	<p>Species that are of value in the context of the site only.</p> <p>Populations of common and widespread species.</p>
<p>¹ Such species include those listed within the Directive 2009/147/EC on the Conservation of Wild Birds (<i>i.e.</i> EC Birds Directive) (codified version of Council Directive 79/409/EEC as amended) or animal or plant species listed within Council Directive 92/43/EEC on the Conservation of Natural Habitats and of Wild Flora and Fauna (<i>i.e.</i> Habitats Directive).</p> <p>²Such populations include sub-populations that are essential to maintenance of metapopulation dynamics, <i>e.g.</i> critical emigration and, or immigration links between otherwise discrete populations.</p> <p>³Seasonal activity or behaviour upon which survival or reproduction depends.</p> <p>⁴Species which may be considered at the UK or national level mean: birds, other animals and plants which receive legal protection on the basis of their conservation interest (those listed within the Wildlife and Countryside Act 1981 (as amended) Schedule 1, 5 and 8); species listed for their principal importance for biodiversity (in accordance with the Natural Environment and Communities</p>	

Importance of Ornithological Features	Descriptors and Examples of Criteria
	<p>Act 2006 Section 41 England), priority species listed within the UK Post 2010 Biodiversity Framework (<i>i.e.</i> UK Biodiversity Action Plan (UKBAP)), or species listed within the Red Data Book.</p> <p>⁵Such species include those listed in the appropriate Natural Character Area description.</p> <p>⁶Such species include those at county level (<i>i.e.</i> Oxfordshire) including unitary authority area <i>i.e.</i> District level (<i>i.e.</i> South Oxfordshire); and listed as a county designated site.</p> <p>*As well as assigning importance there is also a need to identify all legally protected species that could be affected by the Scheme in order that measures can be taken to ensure that adherence to the relevant legislation is observed. This may include the adoption of mitigation and appropriate licensing which are acceptable to Natural England.</p>

3.4 Assumptions and Limitations

Desk Study

- 3.4.1 The information collected from the desk study background record search, represented only those records submitted to records centres and is therefore not considered to be a definitive list of protected and priority bird species identified within the desk study area. If records have not been provided, this does not confirm absence of breeding birds from within the Site.
- 3.4.2 The aim of a desk study was to help characterise the baseline context of the Scheme and provide valuable background information that will not be captured by site surveys alone. Information obtained during the desk study was dependent upon people and organisations having made and submitted records for the area of interest. As such, a lack of species records does not necessarily mean that the species does not occur in the survey area. Likewise, the presence of records of species does not automatically mean that these still occurred within the area of interest or were relevant in the context of the Scheme.

Field Survey

- 3.4.3 There were no significant limitations on the survey for the general breeding bird assemblage. During the survey period where any access was not granted, or was restricted, within the survey area (as defined in section 3.2 of this report), stopping points were located outside of these areas. Using this method, any birds that were heard singing or were observed from outside of any area with access limitations were recorded.
- 3.4.4 There were no significant limitations on the survey for Barn Owl and other WCA Schedule 1 species within 500 m of the Site.

4. Results

4.1 Desk Study

- 4.1.1 Records of 95 protected or notable bird species, recorded within the last ten years were returned from the TVERC within 2 km of the Site.
- 4.1.2 A full list of the 95 protected or notable bird species recorded during the desk study is included in Appendix A.

4.2 Field Survey

Territory Mapping Survey – General Breeding Bird Assemblage

- 4.2.1 A total of 87 species was recorded within the survey area during the survey of the general breeding bird assemblage between April and June 2020 and species-specific surveys for WCA Schedule 1 species between March and August 2020. Tawny Owl (*Strix aluco*) was also recorded during bat activity surveys for the Scheme, between May and July 2020. Of these 87 species, breeding territories of 53 species were confirmed and records of a further 14 species considered to be probably or possibly on breeding territories within the survey area, resulting in a breeding bird assemblage of 67 species. Records relating to the remaining 20 species were of non-breeding species.
- 4.2.2 A summary of the breeding and conservation status of the 87 species recorded during the survey, with the numbers of breeding territories identified (or thought likely in the case of possible or probable records) is provided in Table 4.1. Breeding territory information for records of ‘possible’ breeders was not calculated, due to the low number of registrations of birds, but an estimation of the possible number of territories is included in parentheses in Table 4.1.
- 4.2.3 For species which are widespread throughout the survey area (e.g. Blue Tit (*Cyanistes caeruleus*)), common within Oxfordshire and the UK and not of conservation concern (i.e. not listed on one or more of the lists of conservation concern as detailed in this report), the number of breeding territories of these species (including probable or possible) have not been calculated and these are referred to in Table 4-1 as being present (P).
- 4.2.4 Breeding territory information for records of ‘possible’ breeders was also not calculated, due to the low number of registrations of birds; however, an estimation of the possible number of territories is included in parentheses in Table 4-1.

Table 4-1: The breeding and conservation status of bird species recorded within the survey area during the breeding bird survey, April to June 2020

Species (English Name)	Scientific Name	Conservation Status (where applicable)	Breeding Status	Total number of breeding territories (where applicable) (P = present)
Canada Goose	<i>Branta canadensis</i>	-	Confirmed	3
Mute Swan	<i>Cygnus olor</i>	BoCC Amber	Confirmed	2
Greylag Goose	<i>Anser anser</i>	BoCC Amber	Confirmed	1
Egyptian Goose	<i>Alopochen aegyptiaca</i>	-	Confirmed	1-2
Shoveler	<i>Anas clypeata</i>	BoCC Amber	Probable	1-2
Gadwall	<i>Anas strepera</i>	BoCC Amber	Probable	1-2
Wigeon	<i>Anas penelope</i>	BoCC Amber	Non-breeding	0
Mallard	<i>Anas platyrhynchos</i>	BoCC Amber	Confirmed	9
Teal	<i>Anas crecca</i>	BoCC Amber	Non-breeding	0
Tufted Duck	<i>Aythya fuligula</i>	-	Confirmed	5

Species (English Name)	Scientific Name	Conservation Status (where applicable)	Breeding Status	Total number of breeding territories (where applicable) (P = present)
Red-legged Partridge	<i>Alectoris rufa</i>	-	Confirmed	P
Grey Partridge	<i>Perdix perdix</i>	Priority Species, BoCC Red	Possible	(1)
Pheasant	<i>Phasianus colchicus</i>	-	Confirmed	P
Little Grebe	<i>Tachybaptus ruficollis</i>	-	Probable	1
Great Crested Grebe	<i>Podiceps cristatus</i>	-	Confirmed	2
Grey Heron	<i>Ardea cinerea</i>	-	Non-breeding	0
Little Egret	<i>Egretta garzetta</i>	Annex 1	Non-breeding	0
Cormorant	<i>Phalacrocorax carbo</i>	-	Non-breeding	0
Sparrowhawk	<i>Accipiter nisus</i>	-	Non-breeding	0
Marsh Harrier	<i>Circus aeruginosus</i>	Annex 1, WCA Schedule 1	Non-breeding	0
Red Kite	<i>Milvus milvus</i>	Annex 1, WCA Schedule 1	Confirmed	Minimum of 5
Buzzard	<i>Buteo buteo</i>	-	Possible	(1-2)
Moorhen	<i>Gallinula chloropus</i>	-	Confirmed	3
Coot	<i>Fulica atra</i>	-	Confirmed	P
Oystercatcher	<i>Haematopus ostralegus</i>	BoCC Amber	Confirmed	1
Lapwing	<i>Vanellus vanellus</i>	Priority Species, BoCC Red	Confirmed	2
Golden Plover	<i>Pluvialis apricaria</i>	Annex 1	Non-breeding	0
Ringed Plover	<i>Charadrius hiaticula</i>	BoCC Red	Possible	(1)
Little Ringed Plover	<i>Charadrius dubius</i>	WCA Schedule 1	Confirmed	2-3
Black-headed Gull	<i>Chroicocephalus ridibundus</i>	BoCC Amber	Non-breeding	0
Herring Gull	<i>Larus argentatus</i>	Priority Species, BoCC Red	Non-breeding	0
Lesser Black-backed Gull	<i>Larus fuscus</i>	BoCC Amber	Non-breeding	0
Common Tern	<i>Sterna hirundo</i>	Annex 1, BoCC Amber	Possible	(1-2)
Tawny Owl	<i>Strix aluco</i>	BoCC Amber	Probable	1
Little Owl	<i>Athene noctua</i>	-	Probable	1
Stock Dove	<i>Columba oenas</i>	BoCC Amber	Confirmed	4
Woodpigeon	<i>Columba palumbus</i>	-	Confirmed	P

Species (English Name)	Scientific Name	Conservation Status (where applicable)	Breeding Status	Total number of breeding territories (where applicable) (P = present)
Collared Dove	<i>Streptopelia decaocto</i>	-	Confirmed	3
Cuckoo	<i>Cuculus canorus</i>	Priority Species, BoCC Red	Confirmed	1
Barn Owl	<i>Tyto alba</i>	WCA Schedule 1	Confirmed	1
Swift	<i>Apus apus</i>	BoCC Amber	Non-breeding	0
Kingfisher	<i>Alcedo atthis</i>	Annex 1, WCA Schedule 1, BoCC Amber	Possible	(1-2)
Great Spotted Woodpecker	<i>Dendrocopos major</i>	-	Confirmed	3
Green Woodpecker	<i>Picus viridis</i>	-	Confirmed	2
Kestrel	<i>Falco tinnunculus</i>	BoCC Amber	Probable	1
Hobby	<i>Falco subbuteo</i>	WCA Schedule 1	Non-breeding	0
Peregrine	<i>Falco peregrinus</i>	Annex 1, WCA Schedule 1	Non – breeding	0
Jay	<i>Garrulus glandarius</i>	-	Confirmed	1
Magpie	<i>Pica pica</i>	-	Confirmed	P
Jackdaw	<i>Corvus monedula</i>	-	Probable	3
Rook	<i>Corvus frugilegus</i>	-	Confirmed	P
Carrion Crow	<i>Corvus corone</i>	-	Confirmed	P
Coal Tit	<i>Parus ater</i>	-	Non-breeding	0
Blue Tit	<i>Cyanistes caeruleus</i>	-	Confirmed	P
Great Tit	<i>Parus major</i>	-	Confirmed	P
Skylark	<i>Alauda arvensis</i>	Priority Species, BoCC Red	Confirmed	21
Swallow	<i>Hirundo rustica</i>	-	Confirmed	2-3
House Martin	<i>Delichon urbicum</i>	BoCC Amber	Non-breeding	0
Long-tailed Tit	<i>Aegithalos caudatus</i>	-	Confirmed	5
Chiffchaff	<i>Phylloscopus collybita</i>	-	Confirmed	13
Sedge Warbler	<i>Acrocephalus schoenobaenus</i>	-	Confirmed	3
Reed Warbler	<i>Acrocephalus scirpaceus</i>	-	Confirmed	3-4
Blackcap	<i>Sylvia atricapilla</i>	-	Confirmed	26
Lesser Whitethroat	<i>Sylvia curruca</i>	-	Confirmed	2
Whitethroat	<i>Sylvia communis</i>	-	Confirmed	27

Species (English Name)	Scientific Name	Conservation Status (where applicable)	Breeding Status	Total number of breeding territories (where applicable) (P = present)
Goldcrest	<i>Regulus regulus</i>	-	Confirmed	5
Wren	<i>Troglodytes troglodytes</i>	-	Confirmed	P
Starling	<i>Sturnus vulgaris</i>	Priority Species, BoCC Red	Confirmed	1
Blackbird	<i>Turdus merula</i>	-	Confirmed	P
Fieldfare	<i>Turdus pilaris</i>	WCA Schedule 1, BoCC Red	Non-breeding	0
Redwing	<i>Turdus iliacus</i>	WCA Schedule 1, BoCC Red	Non-breeding	0
Song Thrush	<i>Turdus philomelos</i>	Priority Species, BoCC Red	Confirmed	16
Mistle Thrush	<i>Turdus viscivorus</i>	Priority Species, BoCC Red	Possible	(1-2)
Robin	<i>Erithacus rubecula</i>	-	Confirmed	P
House Sparrow	<i>Passer domesticus</i>	Priority Species, BoCC Red	Confirmed	2
Dunnock	<i>Prunella modularis</i>	Priority Species, BoCC Amber	Confirmed	29
Yellow Wagtail	<i>Motacilla flava</i>	Priority Species, BoCC Red	Non-breeding	0
Grey Wagtail	<i>Motacilla cinerea</i>	BoCC Red	Confirmed	1
Pied Wagtail	<i>Motacilla alba</i>	-	Confirmed	3
Meadow Pipit	<i>Anthus pratensis</i>	BoCC Amber	Non-breeding	0
Chaffinch	<i>Fringilla coelebs</i>	-	Confirmed	P
Bullfinch	<i>Pyrrhula pyrrhula</i>	Priority Species, BoCC Amber	Possible	(1-2)
Greenfinch	<i>Chloris chloris</i>	-	Confirmed	6
Linnet	<i>Linaria cannabina</i>	Priority Species, BoCC Red	Confirmed	3
Goldfinch	<i>Carduelis carduelis</i>	-	Confirmed	P
Yellowhammer	<i>Emberiza citrinella</i>	Priority Species, BoCC Red	Confirmed	8
Reed Bunting	<i>Emberiza schoeniclus</i>	Priority Species, BoCC Amber	Confirmed	3

Species-specific Surveys

Barn Owl

- 4.2.5 A summary of the results from the survey to determine nesting and roosting sites for Barn Owl, is provided below in Table 4-2. The locations of trees and buildings considered during surveys as having features with potential to support roosting or

breeding Barn Owl, identified during the three stages of survey, are presented in Figure 2.

Table 4-2: Barn Owl nest or roost site classification

Reference	Structure and Location (Grid Ref.)	Distance from the Site (m)	Present / Absent at Time of Survey	Notes
T1	Tree - SU 50339 91130	Within Site	Absent	Large hole south side, 4 m up
T2	Willow tree - SU 52547 91930	288	Present (roosting)	Huge central cavity
N1	Barn Owl nest box - SU 52534 92548	136	Absent	Fresh pellets and droppings. Occupied nest site.
T3	Oak tree - SU 53854 94840	400	Absent	Large hole in trunk, possible barn owl roosting site.
T4	Oak tree - SU 53869 94863	377	Absent	Large tree, with holes in three branches possible barn owl roosting site
T5	Ash tree - SU 54545 96163	5	Absent	Large cavity in trunk with possible barn owl potential.
T6	Ash tree - SU 54531 96163	15	Absent	Large cavity in trunk possible roost for barn owl.
N2	Barn Owl nest box - SU 54507 96175	46	Absent	No evidence of Barn Owl.

Stage 1: On-site Scoping Survey

- 4.2.6 The scoping surveys, undertaken between 17th and 19th March 2020, identified six trees (T1 – T6) and two Barn Owl nest boxes (N1 and N2) (as shown in Figure 2) considered as being potentially suitable for nesting or roosting Barn Owl and therefore required further assessment at Stage 2.

Stage 2 and Stage 3: Investigative field survey and nest site verification

- 4.2.7 The Stage 2 and Stage 3 field surveys were undertaken on 10th and 11th August on T1- T6 and two Barn Owl nest boxes (N1 and N2) that were identified during Stage 1 surveys as being potentially suitable to support nesting or roosting Barn Owl.
- 4.2.8 T1, T3, T4, T5 and T6 (see Figure 2) were confirmed as not being used by Barn Owl as there were no signs of Barn Owl, such as pellets or feathers. T2 was confirmed as a Barn Owl roost site due to the presence of a roosting Barn Owl observed within the tree on 17th March 2020. Barn Owl nest box 1 (N1) was confirmed as an occupied nest site for Barn Owl in August 2020. Barn Owl nest box 2 (N2) was confirmed as not being used by Barn Owl, as there were no signs of Barn Owl, such as pellets or feathers.

Survey of Potential Foraging and Dispersal Habitat

- 4.2.9 Whilst areas of optimal habitat (such as grassland and grassland margins) for Barn Owl is present within the survey area, the majority of habitat is considered unsuitable for foraging Barn Owl, including arable farmland, woodland and urban areas.

Other WCA Schedule 1 Species

- 4.2.10 Although Red Kite was not found to be breeding within the Scheme red line boundary, one nest was found on the redline boundary at OS grid reference SU 52456 92856, and the species was confirmed as breeding within the 500 m survey area around the Site (see 5.2.4 and 5.2.5 below). Peregrine were possibly nesting on the cooling towers outside of the survey area, however these towers have now been demolished. Kingfisher was possibly nesting (based on the number of registrations) along the River Thames, 500 m either side of the Scheme, although a nest site was not located. Marsh Harrier and Hobby were non-breeding within the 500 m survey area around the Site.

5. Evaluation

5.1 Desk Study

5.1.1 Records of 95 protected or notable species were returned from the TVERC desk study. Of these 95 species:

- 23 are listed on Annex 1 of the EU Birds Directive;
- 30 are listed on Schedule 1 of the Wildlife and Countryside Act 1981;
- 23 are listed as a priority species on the UK Biodiversity action plan and as a species of principal importance under Section 41 of the NERC Act;
- 27 species are included on the Birds of Conservation Concern Red List; and
- 50 species are included on the Birds of Conservation Concern Amber List.

5.1.2 Of the 95 protected, or notable species returned from the data search, 38 species have the potential to occur (and possibly breed) within the survey area during the breeding season and 28 of those 38 species were confirmed as having breeding territories, or were probably / possibly on territory, within the survey area during field surveys. The 10 species that were identified during the desk study that have the potential to breed within the survey area, but were either not recorded within the survey area or were recorded within the survey area but not confirmed (or thought probable or/ possible) to be on breeding territories were:

- Avocet *Recurvirostra avosetta*;
- Cetti's Warbler *Cettia cetti*;
- Common Gull *Larus canus*;
- Grasshopper Warbler *Locustella naevia*;
- Hobby;
- House Martin;
- Redshank *Tringa totanus*;
- Swift;
- Willow Warbler *Phylloscopus trochilus*; and
- Yellow Wagtail *Motacilla flava*.

5.2 Field Survey

5.2.1 Breeding territories of 53 species were confirmed within the survey area during surveys for breeding birds in 2020 and a further 14 species were probably or possibly holding breeding territories within the survey area, resulting in a breeding bird assemblage of 67 species.

5.2.2 From the breeding assemblage of 67 species:

- three species are included on Annex 1 of the EU Birds Directive;
- four species are included on Schedule 1 of the Wildlife and Countryside Act (1981, as amended);
- 13 species are listed as a priority species in the UK Biodiversity Action Plan and as a species of principal importance under Section 41 of the NERC Act;

- 12 species are included on the Birds of Conservation Concern Red list; and
- 14 species are included on the Birds of Conservation Concern Amber list.

5.2.3 These species and their relevant statutory protection or list of conservation importance are shown in Table 4-1.

Specially Protected Species

Annex 1 Species

- 5.2.4 Red Kite listed on Annex 1 of the EU Birds Directive was confirmed to be nesting within large trees and woodland within the survey area.
- 5.2.5 A total of three active Red Kite nests were confirmed within the survey area and within the 500 m survey area around the Site (see section 3.2.4 of this report). One nest was found on the Scheme redline boundary at OS grid reference SU 52456 92856. This nest was confirmed as in use by Red Kite due to a pair of Red Kites observed to be building the nest. Another active nest was confirmed 41 m west of the Scheme at OS grid reference SU 51879 94481, due to a Red Kite observed sitting on the nest. The third nest was found 467 m north of the Scheme at OS grid reference SU 54450 96591. This nest was confirmed as in use by Red Kite due to a pair of Red Kite mating adjacent to the nest.
- 5.2.6 Peregrine were observed flying over industrial areas north of A4130 and arable fields north of the River Thames. No signs of breeding, or potential breeding, such as calling, landing in trees, display or interactions with other birds were recorded within the survey area and within the 500 m survey area around the Site (see section 3.2.4).
- 5.2.7 Kingfisher was possibly holding breeding territories within the stretch of the River Thames, 500 m either side of the Site (see section 3.2.4). However, this species was only observed carrying food on a single occasion in May 2020 and the exact location of any nesting attempt could not be confirmed as being within the survey area.
- 5.2.8 Common Tern was possibly holding one or two breeding territories outside of the survey area, within the gravel extraction pits on 'Hanson' owned land.
- 5.2.9 Furthermore, Little Egret, Marsh Harrier, and Golden Plover, included on Annex 1 of the EU Birds Directive, were recorded within the survey area but not considered to be breeding or holding breeding territories within the survey area or within the 500 m survey area around the Site (see section 3.2.4).
- 5.2.10 Golden Plover is predominantly a winter visitor to Oxfordshire and so will not be breeding within the survey area. Marsh Harrier and Little Egret have the potential to breed in the wider area, but individuals of both species were recorded on a single occasion only and therefore it is unlikely that either species was breeding in the wider zone of influence.
- 5.2.11 Red Kite, Peregrine, Kingfisher and Marsh Harrier are also included on Schedule 1 of the Wildlife and Countryside Act (1981, as amended).

Schedule 1 listed species

- 5.2.12 Little Ringed Plover and Barn Owl, two species included on Schedule 1 of the Wildlife and Countryside Act (1981, as amended), were confirmed to be on breeding territories within the survey area.

- 5.2.13 Two to three breeding territories of Little Ringed Plover were confirmed within the gravel extraction pits on 'Hanson' owned land.
- 5.2.14 One occupied Barn Owl nest site was confirmed within a Barn Owl nest box located at the Appleford Crossing Pits.
- 5.2.15 Hobby was recorded within the survey area but not considered to be breeding or holding breeding territories within the survey area or within the 500 m survey area around the Site (see section 3.2.4). Hobby has the potential to breed within the survey area but was only recorded on a single occasion and so is currently unlikely to be breeding within the survey area.
- 5.2.16 Two Additionally species (Fieldfare and Redwing) are included on Schedule 1 of the Wildlife and Countryside Act (1981, as amended) but these species are winter visitors to Oxfordshire, rather than a breeding species in the county, with breeding of these species in the UK only very occasionally recorded in northern Scotland.

Priority Species

- 5.2.17 Thirteen species (Grey Partridge, Lapwing, Cuckoo, Skylark, Starling, Song Thrush, Mistle Thrush, House Sparrow, Dunnock, Bullfinch, Yellowhammer and Reed Bunting) included as priority species on the UK Biodiversity Action Plan and listed as Species of Principal Importance under Section 41 of the NERC Act 2006, were confirmed or having probable /or possible breeding territories within the survey area.
- 5.2.18 Yellow Wagtail, a priority species on the UK Biodiversity Action Plan and listed as Species of Principal Importance under Section 41 of the NERC Act 2006, was also recorded within the survey area but not considered to be breeding or holding breeding territories. Yellow Wagtail has the potential to breed within the survey area but was only recorded on a single occasion and so is unlikely to be breeding within the survey area.

Birds of Conservation Concern

- 5.2.19 Breeding territories were confirmed, or thought probable / possible, for thirteen species (Grey Partridge, Lapwing, Ringed Plover, Cuckoo, Skylark, Starling, Song Thrush, Mistle Thrush, House Sparrow, Grey Wagtail, Linnet and Yellowhammer) within the survey area that are included on the BoCC Red List.
- 5.2.20 Breeding territories were confirmed, or thought probable, or possible, for fourteen species (Mute Swan, Greylag Goose, Shoveler, Gadwall, Mallard, Oystercatcher, , Common Tern, Tawny Owl, Stock Dove, Kingfisher, Kestrel, Dunnock, Bullfinch and Reed Bunting) within the survey area that are included on the BoCC Amber List.

5.3 Species Abundance

- 5.3.1 In addition to evaluating a site based on its populations of breeding birds in relation to legal status, rarity and conservation value, consideration is given to the value of the site for the population of individual species that it supports. This can be done by comparing the population present within the survey area with the national and county breeding population for certain species.
- 5.3.2 No species were present within the survey area in numbers of national significance, *i.e.* 1% or more of the UK population, when compared to national population estimates as given in a paper by Woodward *et al* (2020).

5.3.3 Within the gravel extraction pits on 'Hanson' owned land, two-three Little Ringed Plover territories were confirmed, which represent 60% of the reported county breeding estimates (5), as reported by the most recently available report published by the Rare Breeding Birds Panel (RBBP) (Hollings *et al.*, 2019²⁴). However, only one pair was present within the Scheme area, with the two further territories to the west of the Scheme. On this basis, the breeding population of Little Ringed Plover is of importance at a **district** level. One to two pairs of Gadwall were also thought probable within the survey area, with one pair likely to be using habitat within the Scheme boundary, although nesting was not confirmed. This species is no longer represented by the RBBP, a Gadwall breeding territory is likely to be of **district** level importance. Furthermore, one to two possible breeding pairs of Common Tern territories were recorded within the gravel extraction pits outside of the survey area. Whilst this species is not considered a rare breeding bird nationally, it is likely that these are of **district** importance.

5.3.4 No other species recorded in the survey area were recorded in numbers approaching 1% of the county breeding population estimates in Oxfordshire. The numbers of individuals for most of each species recorded were all relatively low and did not represent significant proportions (*i.e.* 1 % or more) of the county populations in Oxfordshire.

5.4 Species Diversity

5.4.1 To measure species diversity, the breeding assemblage (67) recorded in the survey area was evaluated against the criteria developed by Fuller (1970) and taking into consideration that species diversity has declined significantly since the criteria were developed. The breeding assemblage of 67 species will place the value of the Site, as being of **county** importance for breeding birds.

5.4.2 Evaluation of the breeding species assemblage and numbers recorded during surveys, with respect to criteria for selection of Local Wildlife Sites (of County value) (as detailed in Section 3.3 of this report) highlights that the survey area:

- does support the notable species Common Tern but not at the threshold required for LWS selection, as defined within the LWS selection criteria; and
- does not support a breeding assemblage with a value equal to, or exceeding, the indices of representative habitats (see Section 3.3 of this report) within the survey area

5.4.3 This assessment further supports that the importance of the Scheme for breeding birds is no more than **county** level.

5.5 Species Distribution

5.5.1 The location of Annex 1 species, Schedule 1 species, Priority species, BoCC Red and Amber-listed bird species, (see Table 4.1) are shown in Figures 3a-3c. In general, concentrations of species were found within the most suitable habitats to support each individual species' needs (*i.e.* species reliant on waterbodies were found on the Site close to water, species that require woodland habitat, were found within woodland habitat on the Site, *etc.*).

5.6 Evaluation of key habitat types for breeding birds

5.6.1 The broad habitat types present in the survey area have been evaluated for their importance of breeding bird assemblages that they support. Each habitat found within

²⁴ Hollings, M. & the Rare Breeding Birds Panel (2019) Rare breeding birds in the UK in 2017. *British Birds* 112, 706-758.

the survey area and its key features for breeding birds are detailed below in Table 5.1.

Table 5-1: The broad habitat types found within the Site and habitat key features of each for breeding birds

Broad Habitat Type	Key Features
Waterbodies (including the River Thames)	A large number of waterbodies associated with the former gravel extraction and a large number of established ponds within the survey area, including a stretch of the River Thames. These waterbodies support species associated with wetland features, such as Shoveler, Gadwall, Mallard (and other waterfowl) and gulls. These waterbodies also support species associated with wetland margins, including Little Ringed Plover, Lapwing and Oystercatcher. Individual species of conservation interest and high species diversity and abundance.
Arable farmland	The predominant habitat type occurring across the survey area and wider landscape beyond the survey area. Supports seed-eating passerines, including Skylark, Yellowhammer, Reed Bunting and Linnet, found throughout. Individual species of conservation interest, but limited species abundance and diversity.
Scrub / hedgerows	Frequently occurring habitat across the survey area of varying quality. Supports species such as Yellowhammer, Dunnock, Song Thrush and Bullfinch. Individual species of conservation interest, but limited species abundance and diversity.
Poor Semi-improved Grassland	Large areas of this habitat associated with the former landfill and formal gravel extraction areas. Supports notable species, such as Linnet, Meadow Pipit and Skylark. Individual species of conservation interest, but limited species abundance and diversity.
Mature trees / woodland	Restricted parcels of woodland and individual trees scattered throughout the survey area. Supports species such as Red Kite and Barn Owl, as well as species often found in scrub / hedgerows. Individual species of conservation interest, but limited species abundance and diversity.

6. Conclusion

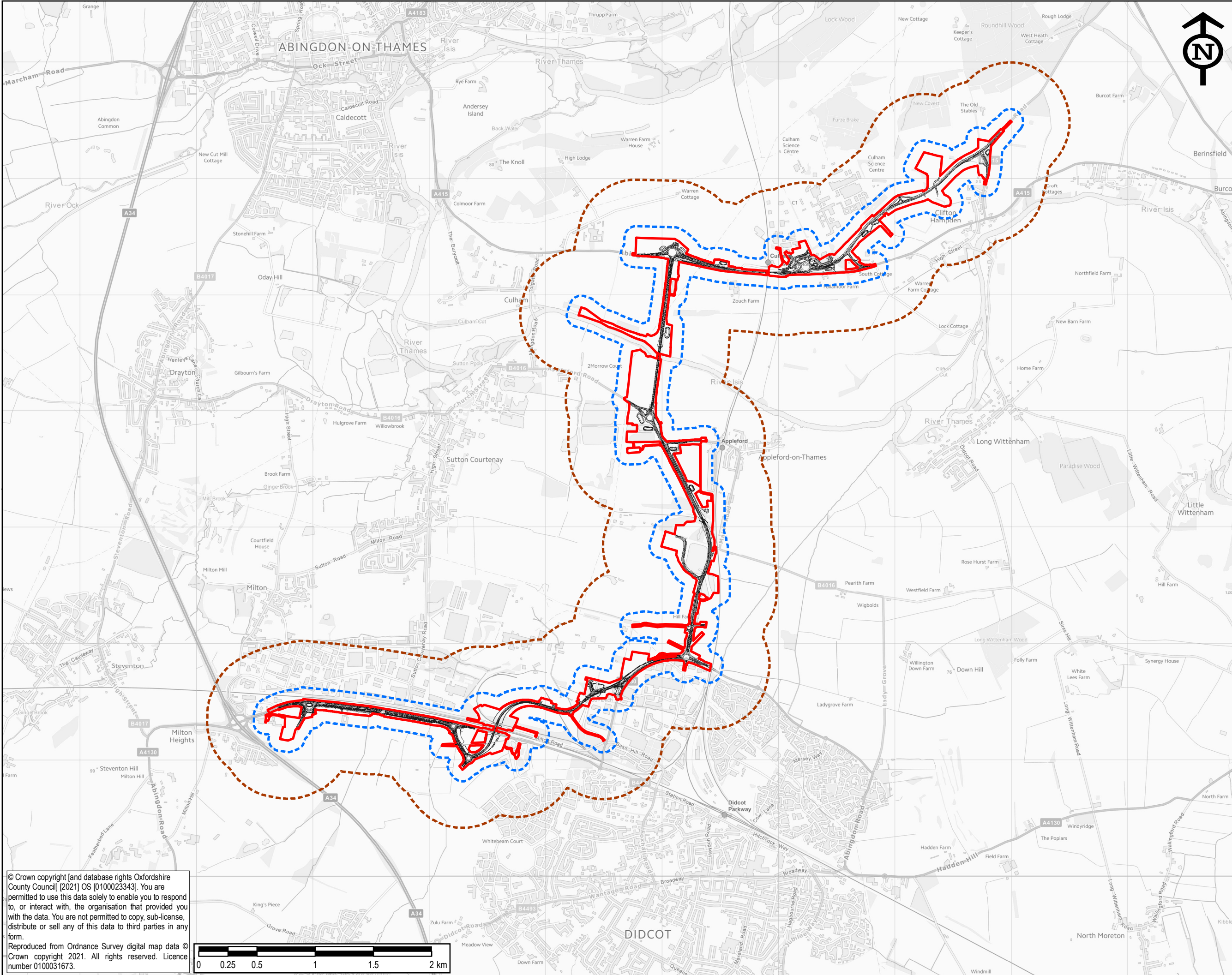
- 6.1.1 Surveys for breeding birds were undertaken monthly between April and June 2020, with a total of six survey visits.
- 6.1.2 Breeding territories of 53 species were confirmed within the survey area during surveys for breeding birds in 2020 and a further 14 species were probably or possibly holding breeding territories within the survey area, resulting in a breeding bird assemblage of 67 species.
- 6.1.3 The breeding assemblage of 67 species will place the value of the Site as being of county importance for breeding birds.
- 6.1.4 Territories of three species listed on Annex 1 of the EU Birds Directive (Red Kite, Common Tern and Kingfisher) and territories of four species (Red Kite, Little Ringed Plover, Barn Owl and Hobby) that are included on Schedule 1 of the Wildlife and Countryside Act 1981 (as amended) were confirmed within the survey area
- 6.1.5 No species were present within the survey area in numbers of national significance, *i.e.* 1% or more of the UK population, when compared to national population estimates as given in a paper by Woodward et al (2020).
- 6.1.6 The populations of Little Ringed Plover, Gadwall and Common Tern within the survey area are of **district importance**.

Figures

Figure 1: Scheme Layout

Figure 2: Barn Owl Survey Results

Figure 3a-c: Location of Territories



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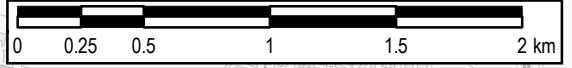
LEGEND

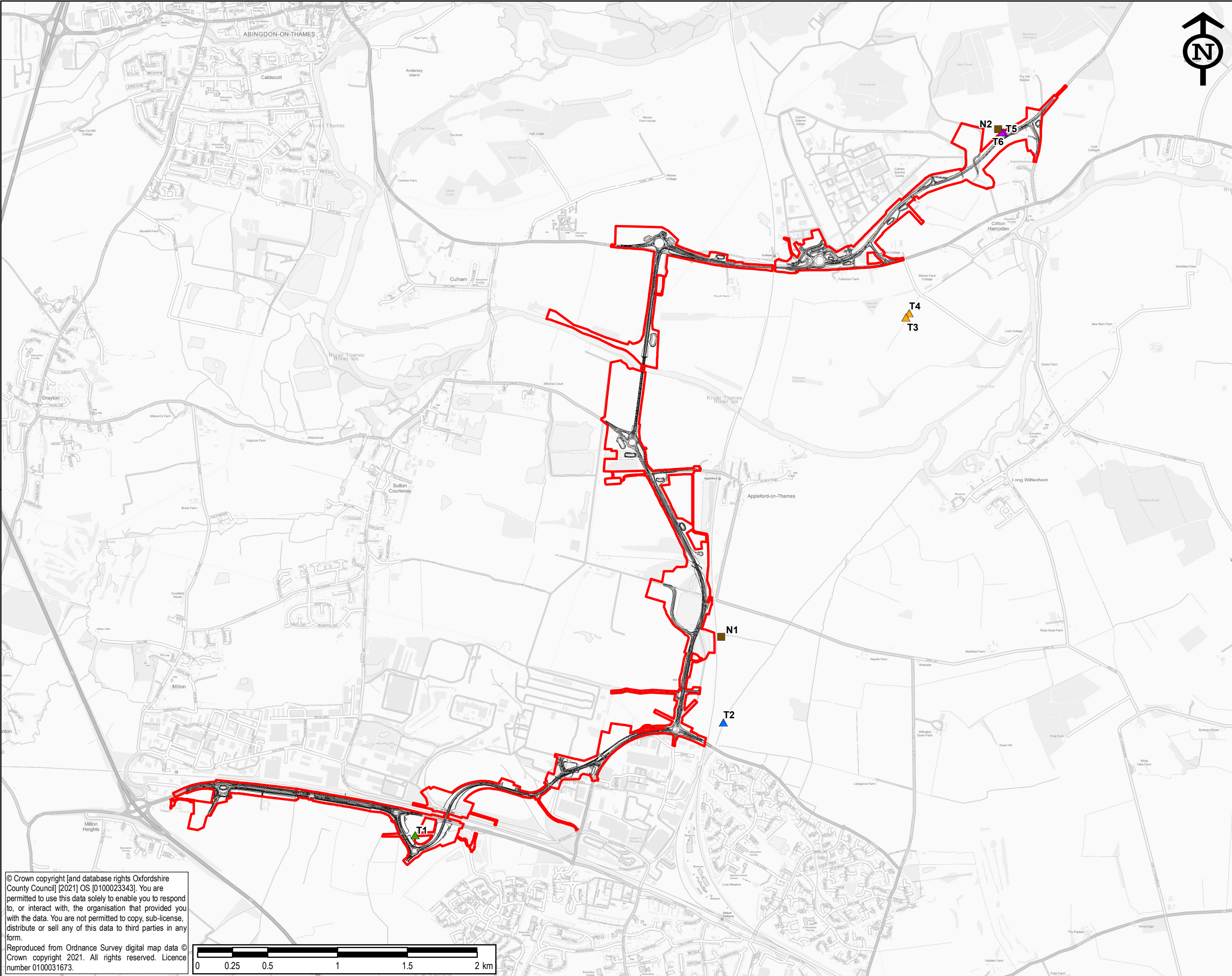
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- Indicative OCC Highway Design (Subject to Change)
- 100m Study Area
- 500m Study Area

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Revision Details	By	Date	Suffix	
Purpose of Issue				
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Client				
OXFORDSHIRE COUNTY COUNCIL				
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DIDCOT GARDEN TOWN HIF 1 SCHEME				
Drawing Title				
FIGURE 1 SCHEME LOCATION				
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LEGEND

- Indicative Red Line Boundary (Subject to Change)
- Indicative HIF 1 Highway Design (Subject to Change)
- Barn Owl Nest Box
- Tree
- Ash Tree
- Oak Tree
- Willow Tree

First Issue	AG	AB	05/07/2021	P01
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Purpose of Issue

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HIF 1 SCHEME

Drawing Title

FIGURE 2
BARN OWL (TYTO ALBA)
STAGE 1-3 ASSESSMENT SURVEY
RESULTS

Designed AG	Drawn AG	Checked AB	Approved AB	Date 23/08/2021
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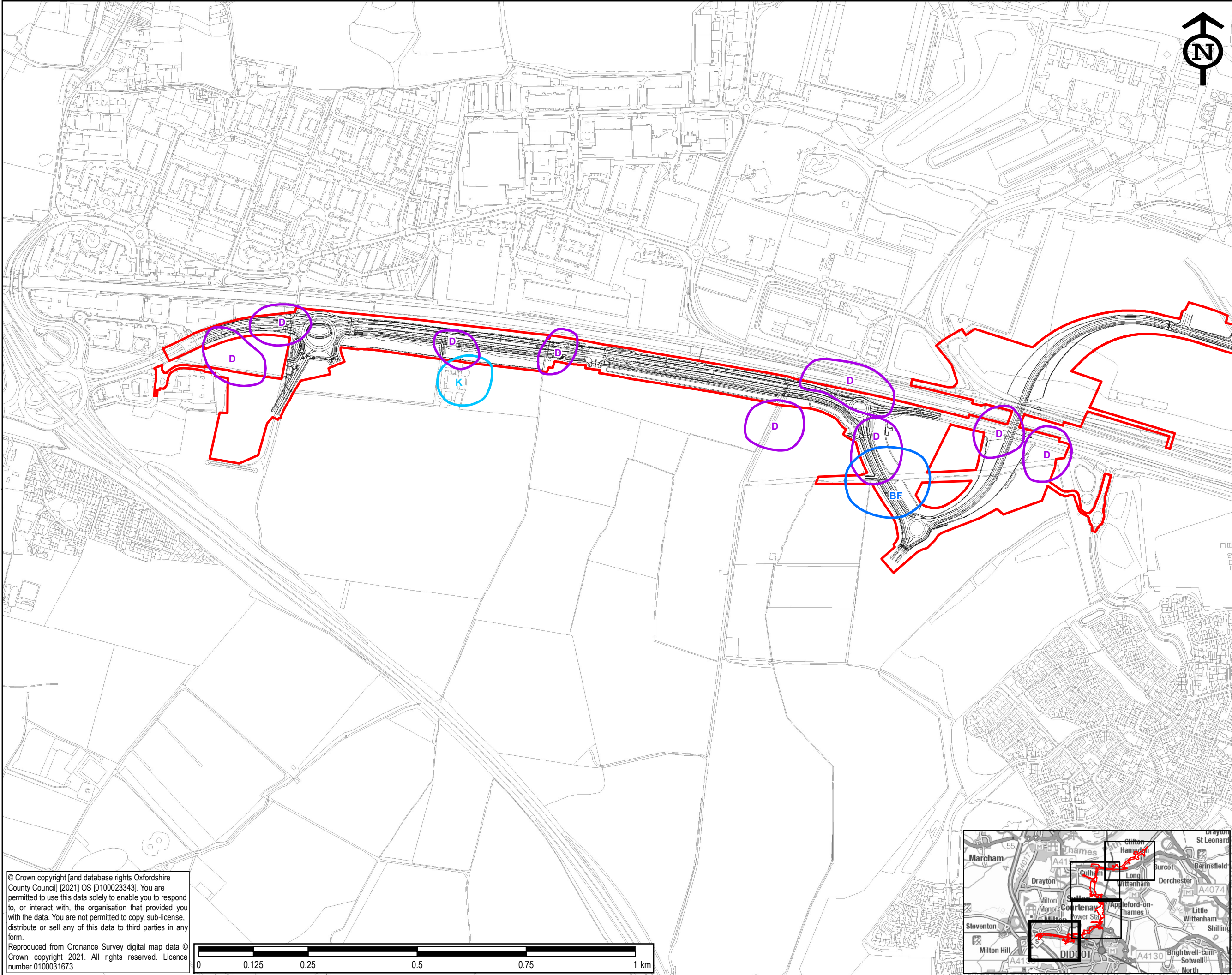
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LEGEND

Indicative Red Line Boundary (Subject to Change)

Indicative HIF 1 Highway Design (Subject to Change)

Breeding Bird Territory:

Bullfinch (BF)

Dunnock (D)

Kestrel (K)

First Issue	AG	AB	05/07/2021	P01
Revision Details	By	Check	Date	Suffix

Purpose of Issue

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DIDCOT GARDEN TOWN
HIF 1 SCHEME

Drawing Title

FIGURE 3A
BREEDING BIRD SURVEY
AMBER LIST SPECIES
SHEET 1

Designed AG	Drawn AG	Checked AB	Approved AB	Date 23/08/2021
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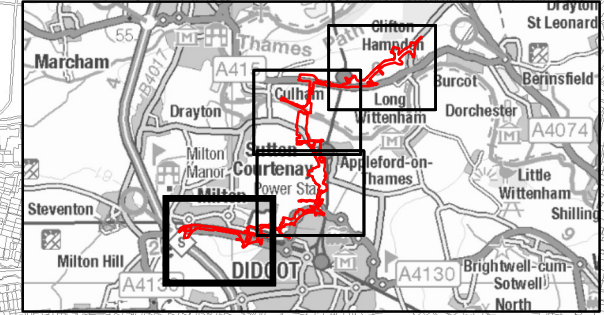
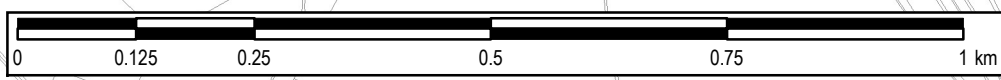
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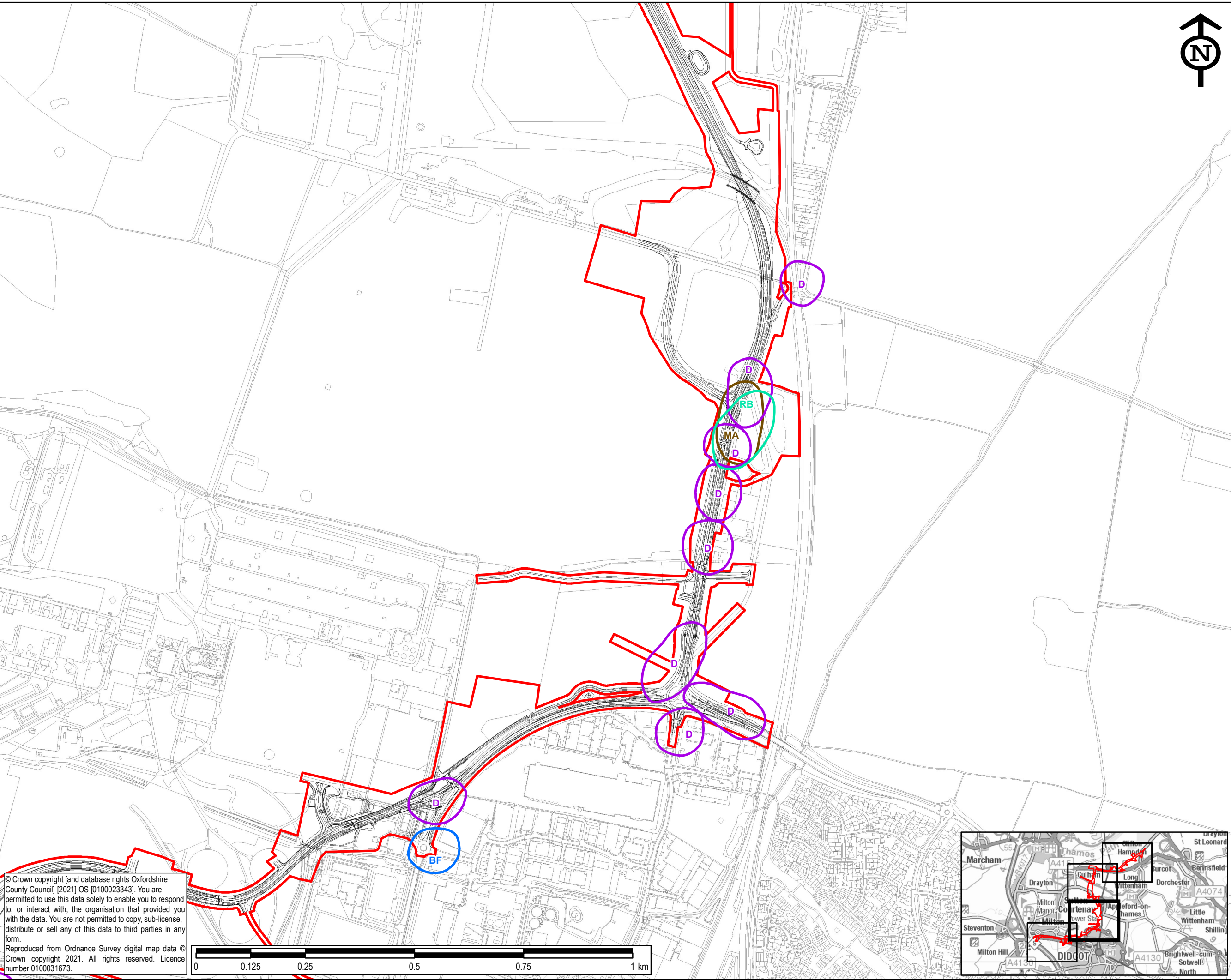
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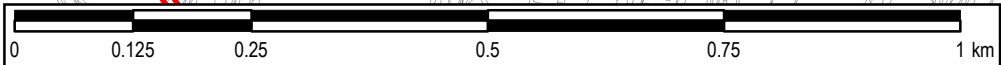
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LEGEND

- Indicative Red Line Boundary (Subject to Change)
- Indicative HIF 1 Highway Design (Subject to Change)

Breeding Bird Territory:

- Bullfinch (BF)
- Dunnock (D)
- Mallard (MA)
- Reed Bunting (RB)

First Issue	AG	05/07/2021	P01
Revision Details	By	Date	Suffix
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Project Title
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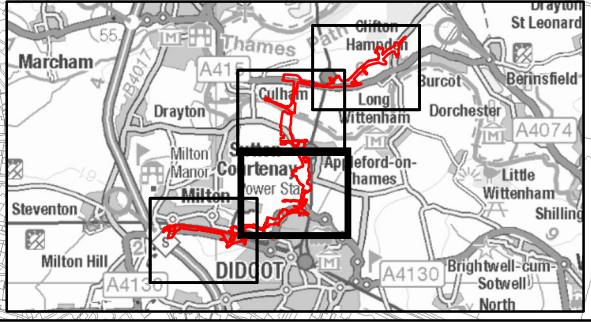
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BREEDING BIRD SURVEY
AMBER LIST SPECIES
SHEET 2

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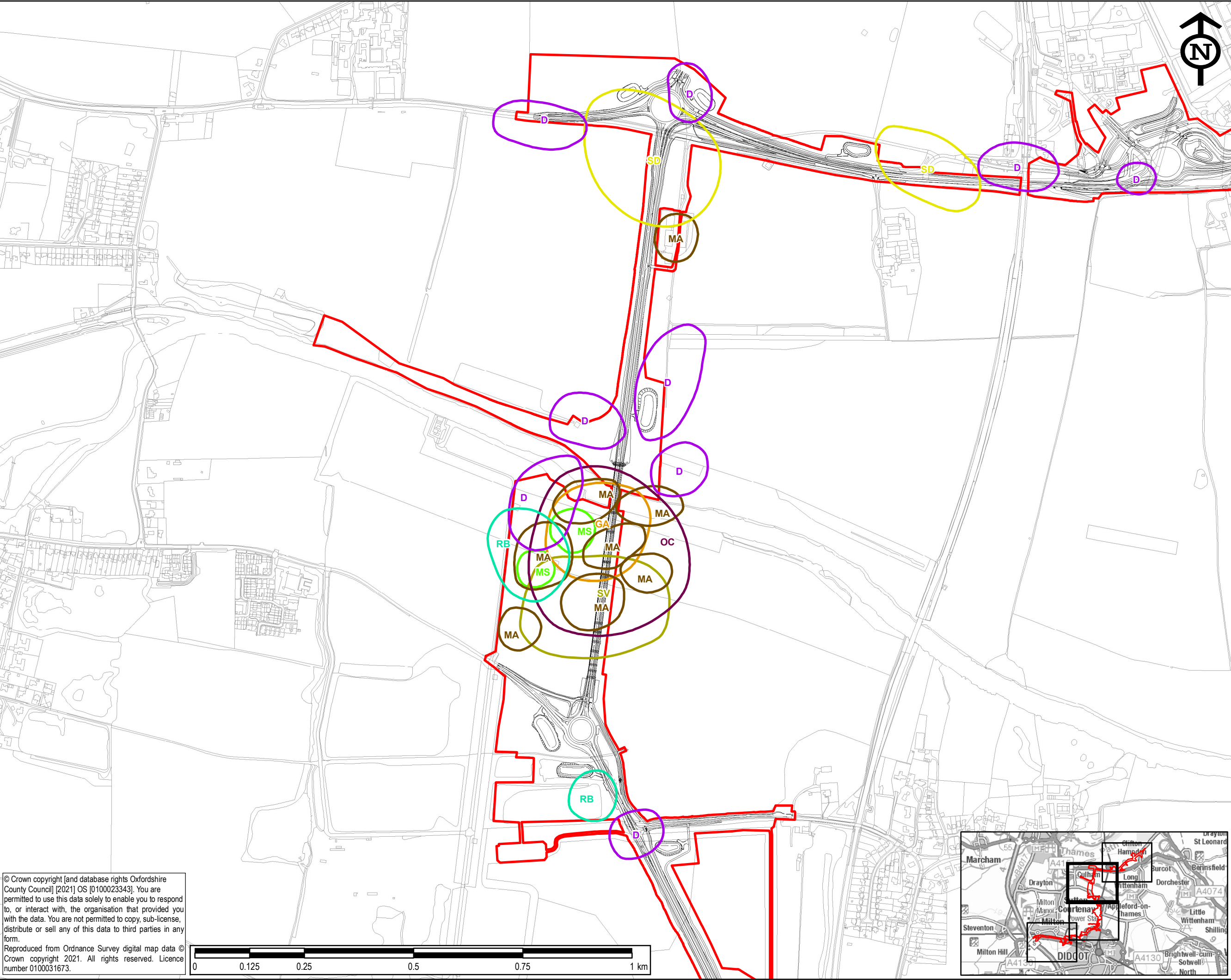
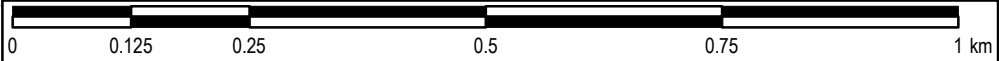
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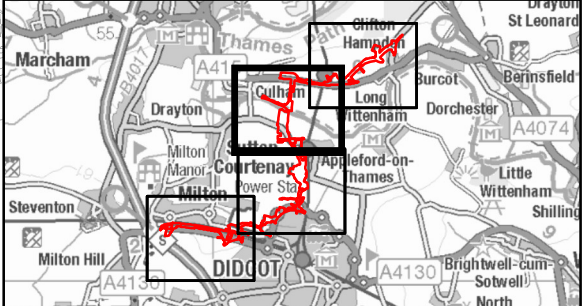
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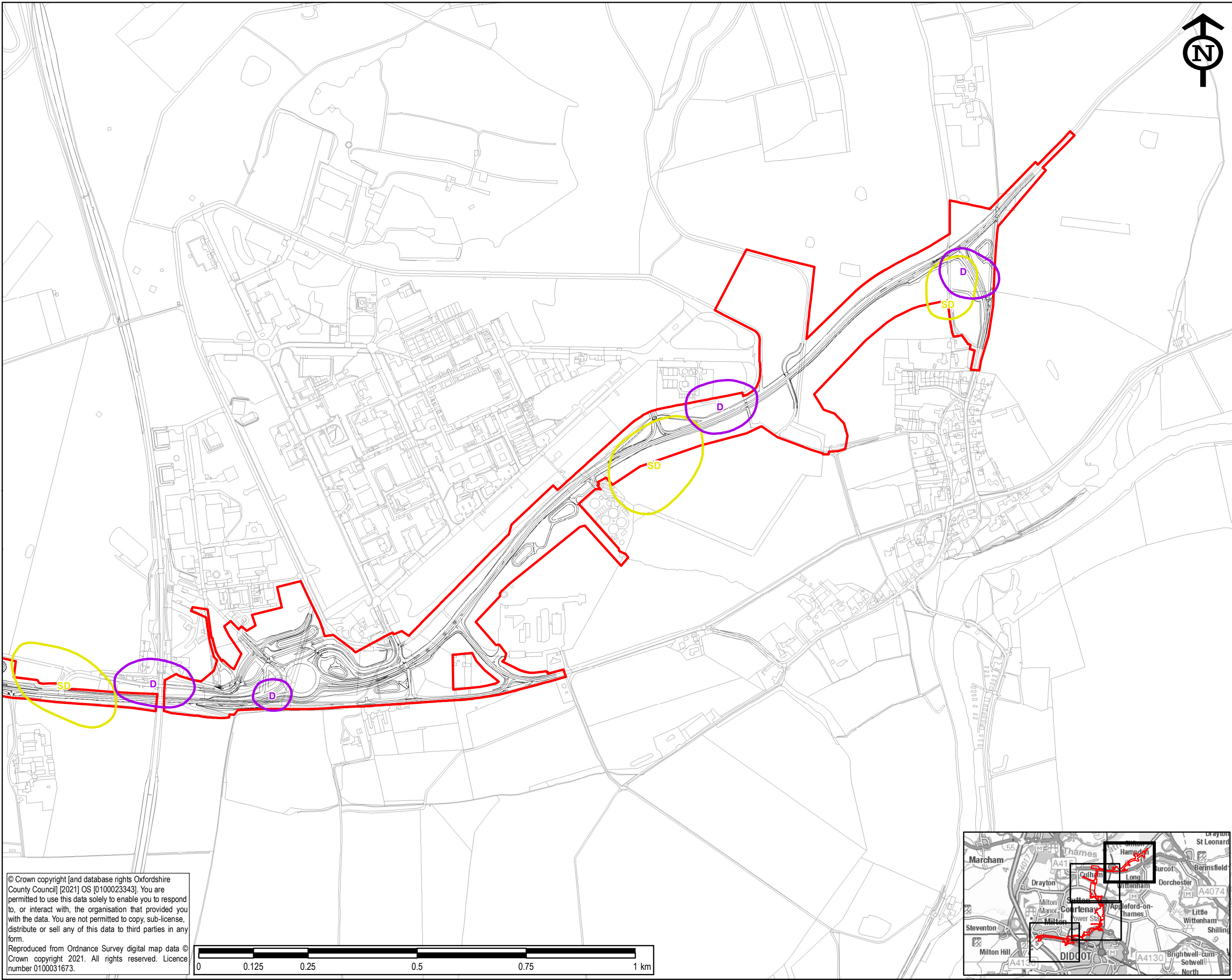
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- Breeding Bird Territory:
 - Dunnock (D)
 - Gadwall (GA)
 - Mallard (MA)
 - Mute Swan (MS)
 - Oystercatcher (OC)
 - Reed Bunting (RB)
 - Shoveler (SV)
 - Stock Dove (SD)

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Revision Details	By	Date	Suffix
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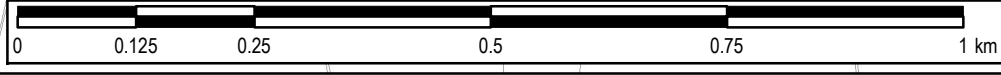
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LEGEND

Indicative Red Line Boundary (Subject to Change)

Indicative HIF 1 Highway Design (Subject to Change)

Breeding Bird Territory:

Dunnock (D)

Stock Dove (SD)

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COUNTY COUNCIL**

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**DIDCOT GARDEN TOWN
HIF 1 SCHEME**

Drawing Title

**FIGURE 3A
BREEDING BIRD SURVEY
AMBER LIST SPECIES
SHEET 4**

Designed AG	Drawn AG	Checked AB	Approved AB	Date 23/08/2021
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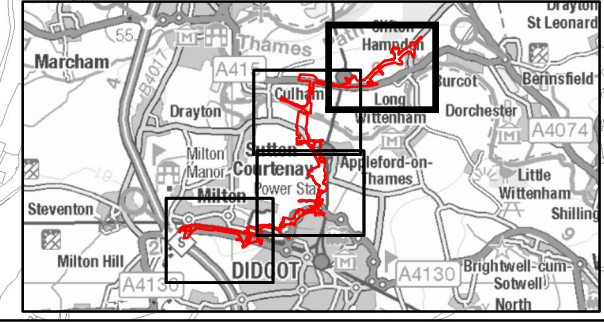
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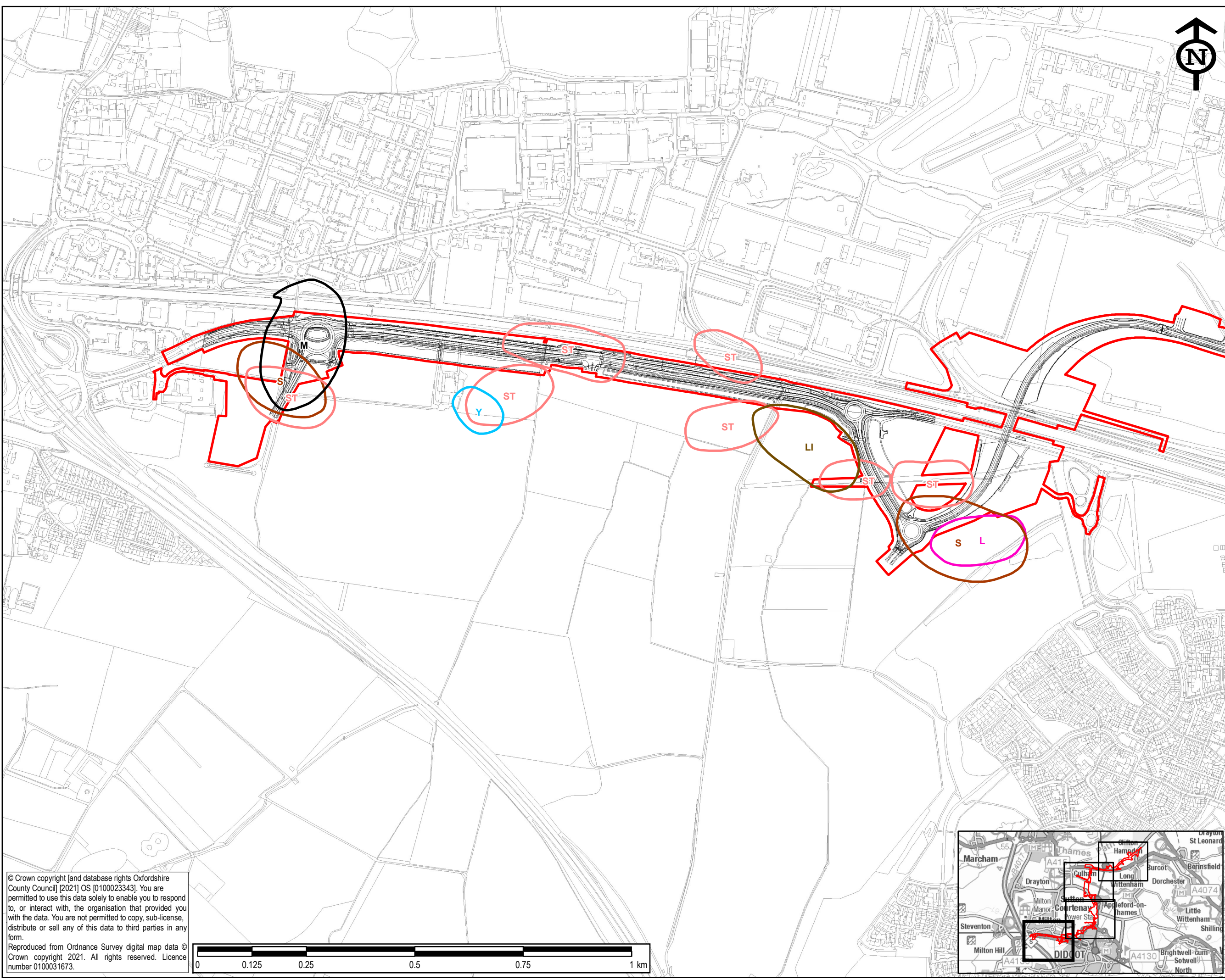
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LEGEND

Indicative Red Line Boundary
(Subject to Change)

Indicative HIF 1 Highway Design
(Subject to Change)

Breeding Bird Territory:

Lapwing (L)

Linnet (LI)

Mistle Thrush (M)

Skylark (S)

Song Thrush (ST)

Yellowhammer (Y)

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HIF 1 SCHEME

Drawing Title

FIGURE 3B
BREEDING BIRD SURVEY
RED LIST SPECIES
SHEET 1

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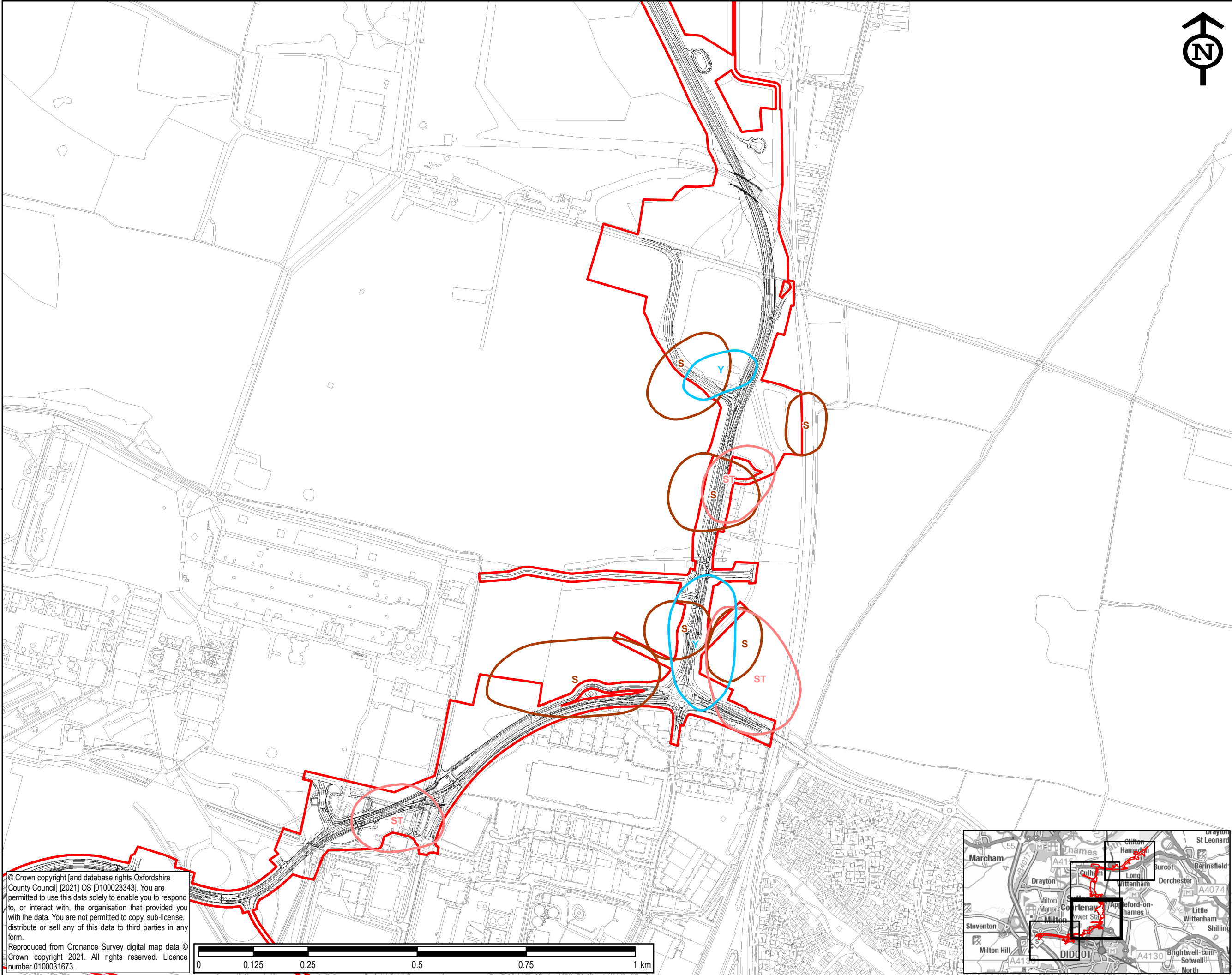
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LEGEND

Indicative Red Line Boundary
(Subject to Change)

Indicative HIF 1 Highway Design
(Subject to Change)

Breeding Bird Territory:

Skylark (S)

Song Thrush (ST)

Yellowhammer (Y)

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Revision Details	By	Check	Date	Suffix

Purpose of Issue

FOR INFORMATION

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New Road
Oxford
OX1 1ND

OXFORDSHIRE
COUNTY COUNCIL

Project Title

DIDCOT GARDEN TOWN
HIF 1 SCHEME

Drawing Title

FIGURE 3B
BREEDING BIRD SURVEY
RED LIST SPECIES
SHEET 2

Designed AG	Drawn AG	Checked AB	Approved AB	Date 23/08/2021
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Internal Project No.
60632497

Suitability
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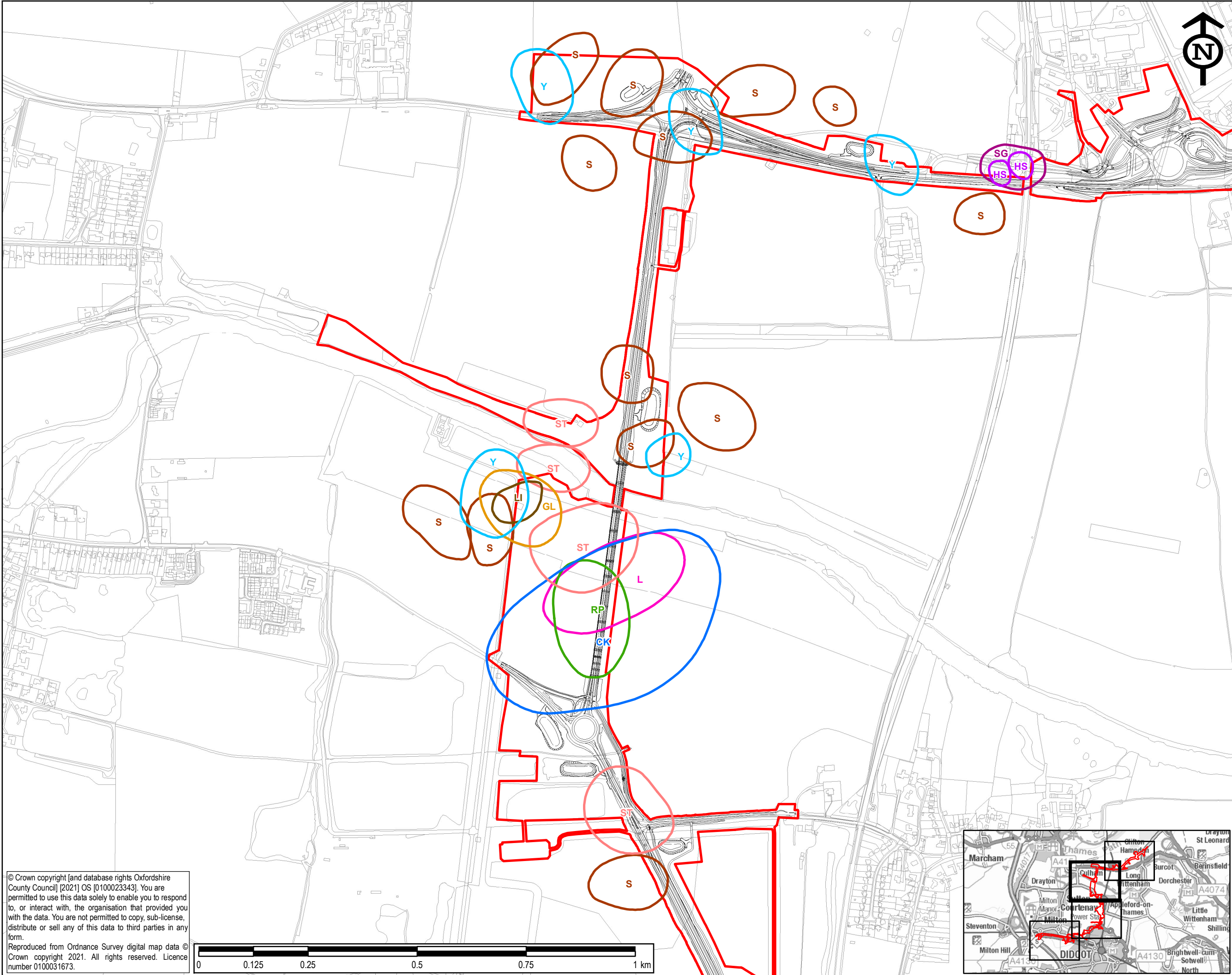
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Indicative HIF 1 Highway Design (Subject to Change)

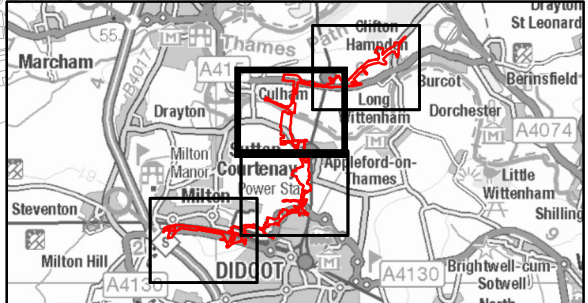
Breeding Bird Territory:

- Cuckoo (CK)
- Grey Wagtail (GL)
- House Sparrow (HS)
- Lapwing (L)
- Linnet (LI)
- Ringed Plover (RP)
- Skylark (S)
- Song Thrush (ST)
- Starling (SG)
- Yellowhammer (Y)

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Revision Details	By	Date	Suffix	
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Purpose of Issue				
FOR INFORMATION				
Client				
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Project Title				
DIDCOT GARDEN TOWN HIF 1 SCHEME				
Drawing Title				
FIGURE 3B BREEDING BIRD SURVEY RED LIST SPECIES SHEET 3				
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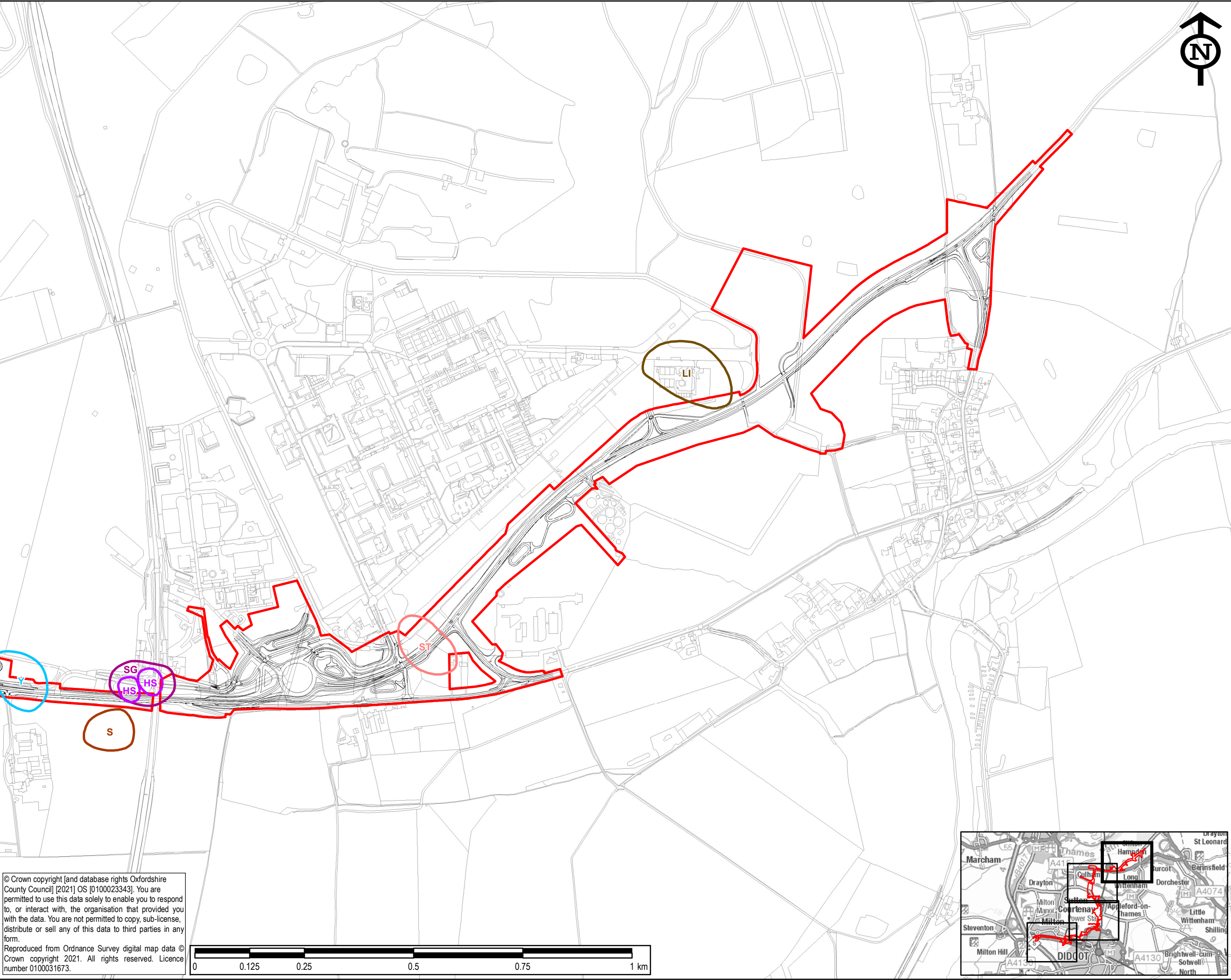
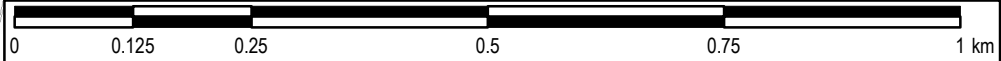
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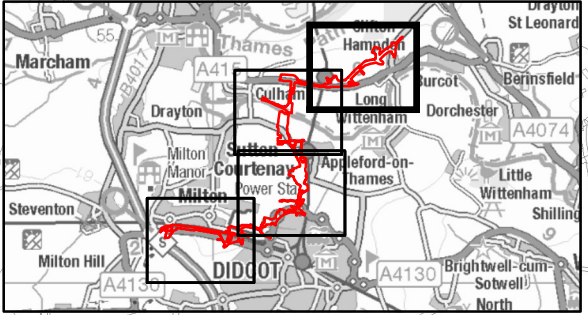
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- Indicative HIF 1 Highway Design (Subject to Change)

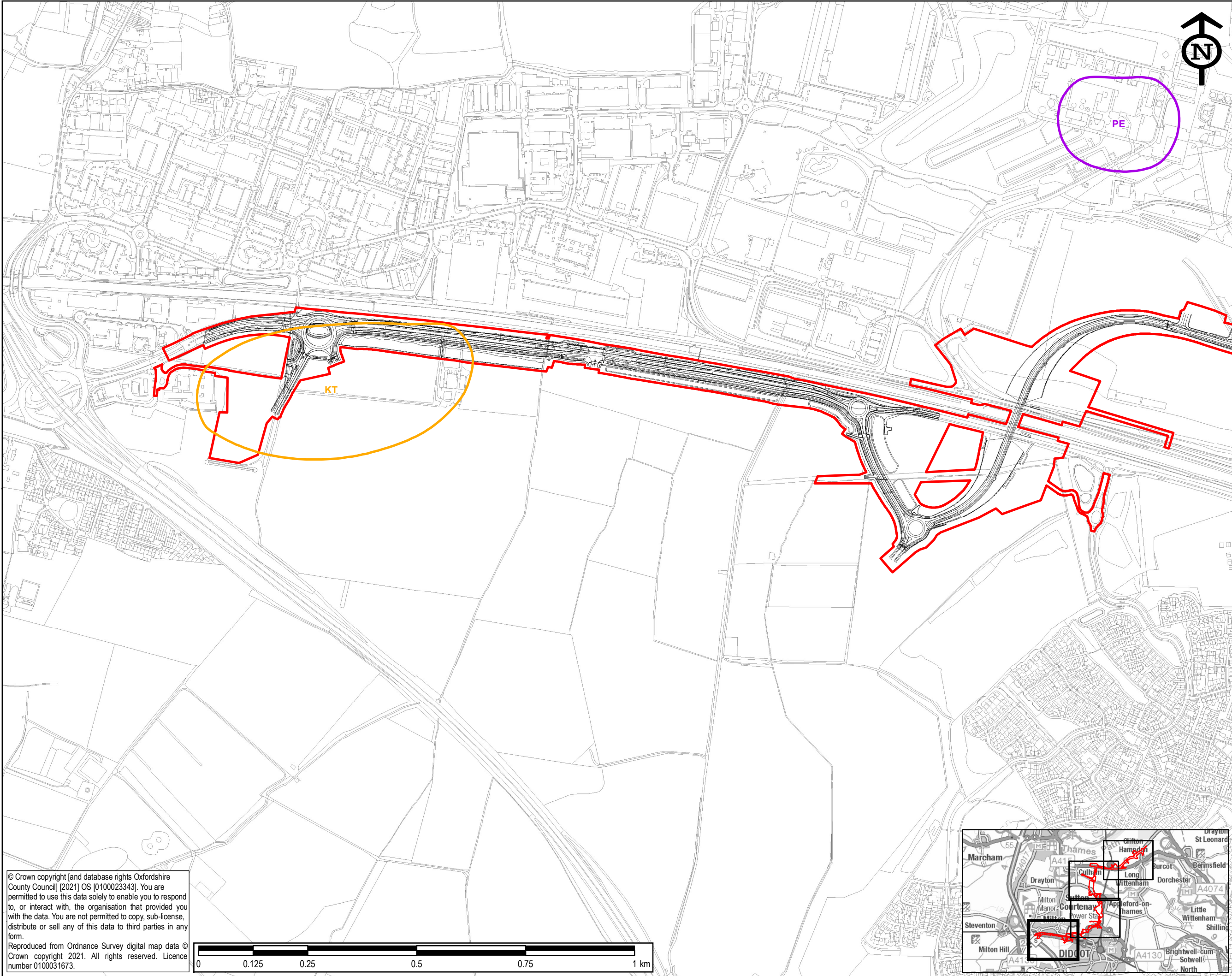
Breeding Bird Territory:

- House Sparrow (HS)
- Linnet (LI)
- Skylark (S)
- Song Thrush (ST)
- Starling (SG)
- Yellowhammer (Y)

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DIDCOT GARDEN TOWN HIF 1 SCHEME				
Drawing Title				
FIGURE 3B BREEDING BIRD SURVEY RED LIST SPECIES SHEET 4				
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LEGEND

Indicative Red Line Boundary (Subject to Change)

Indicative HIF 1 Highway Design (Subject to Change)

Breeding Bird Territory:

Peregrine (PE)

Red Kite (KT)

First Issue	AG	05/07/2021	P01
Revision Details	By	Date	Suffix
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Project Title

DIDCOT GARDEN TOWN
HIF 1 SCHEME

Drawing Title

FIGURE 3C
BREEDING BIRD SURVEY
WCA SCHEDULE 1 SPECIES
SHEET 1

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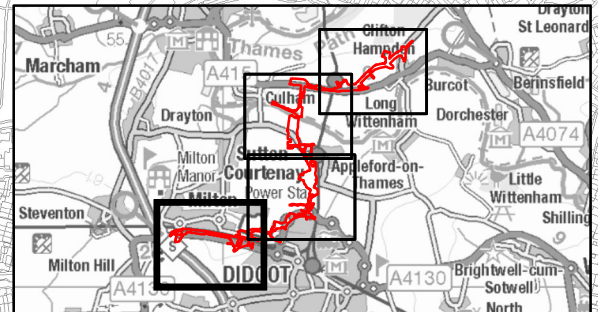
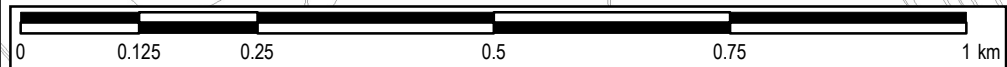
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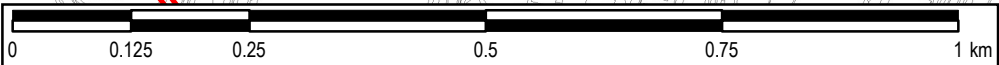
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- Indicative Red Line Boundary (Subject to Change)
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Breeding Bird Territory:

- Barn Owl (BO)
- Peregrine (PE)
- Red Kite (KT)

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HIF 1 SCHEME

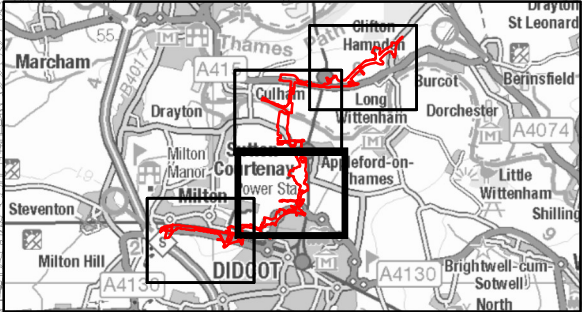
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BREEDING BIRD SURVEY
WCA SCHEDULE 1 SPECIES
SHEET 2

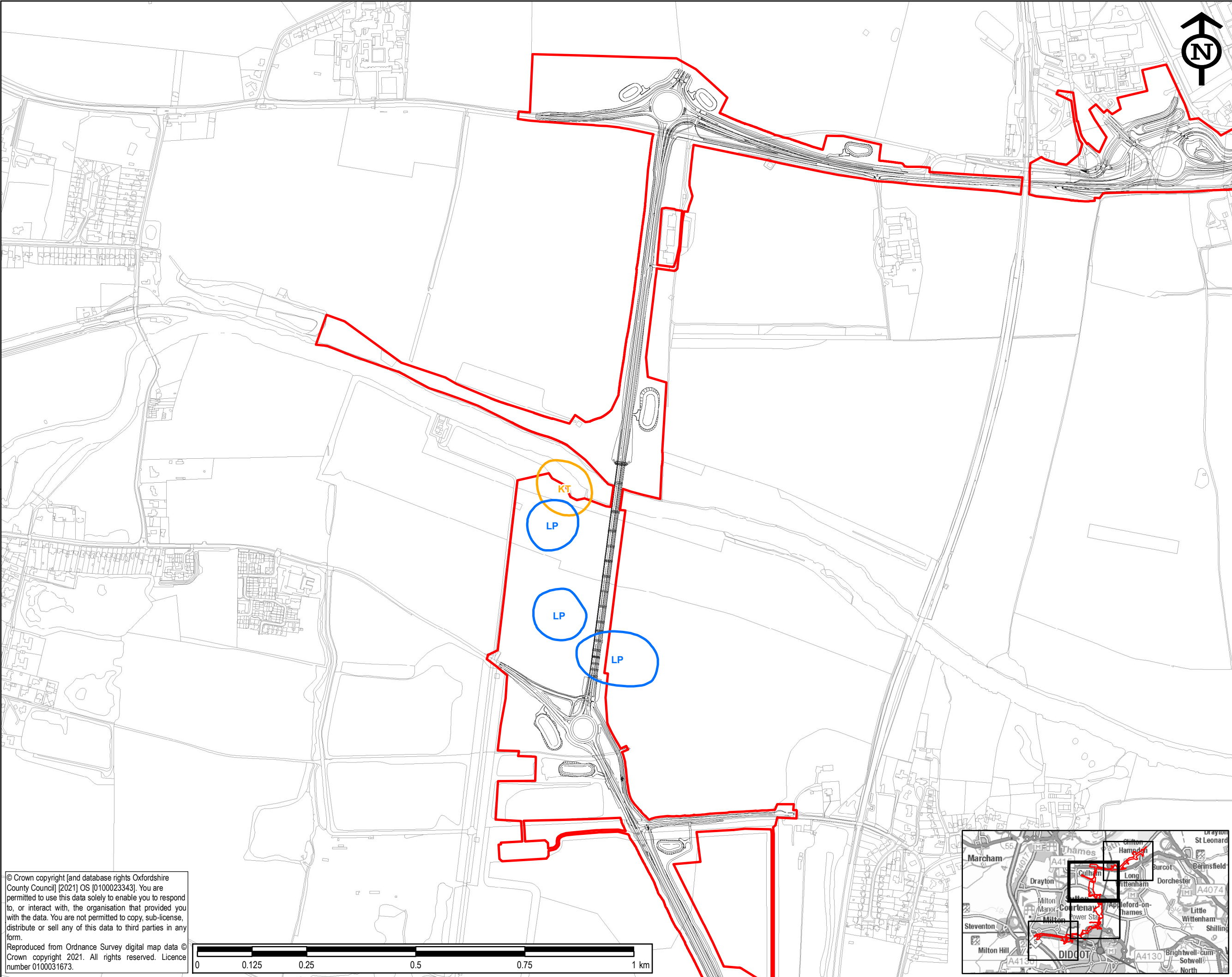
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Scale @ A3 1:8,000		Discipline Ecology		

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Indicative HIF 1 Highway Design (Subject to Change)

Breeding Bird Territory:

Little Ringed Plover (LP)

Red Kite (KT)

First Issue	AG	05/07/2021	P01
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HIF 1 SCHEME

Drawing Title

FIGURE 3C
BREEDING BIRD SURVEY
WCA SCHEDULE 1 SPECIES
SHEET 3

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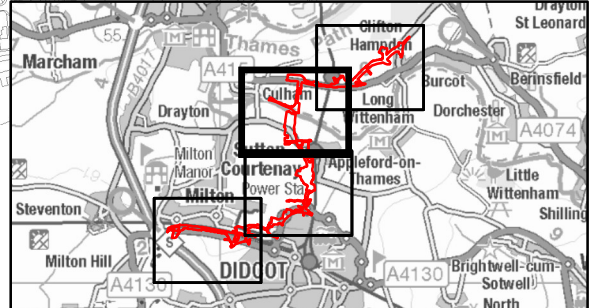
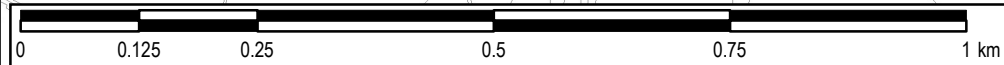
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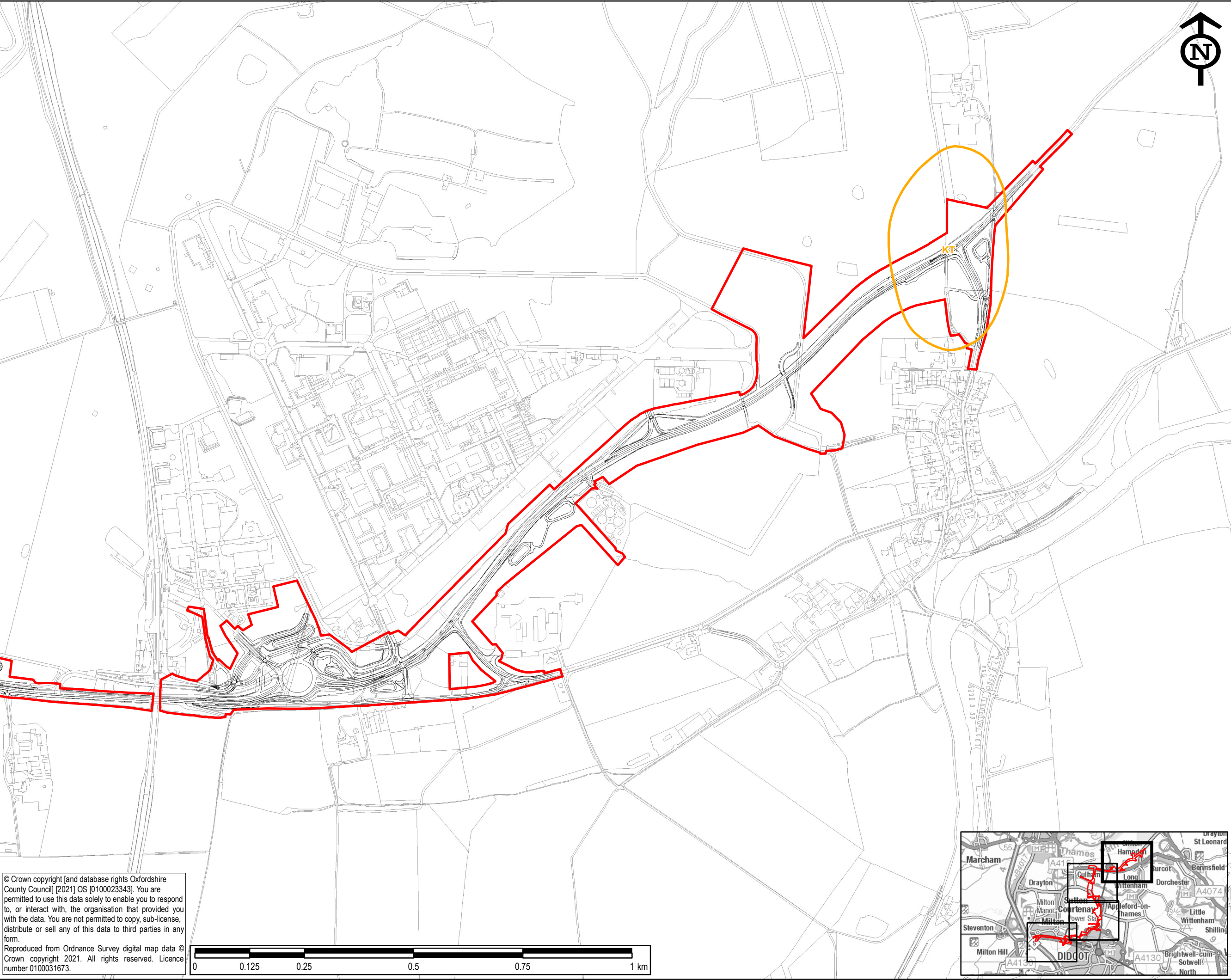
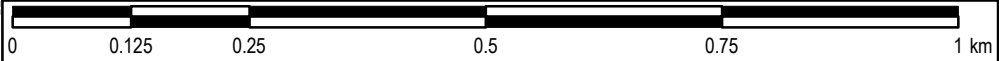
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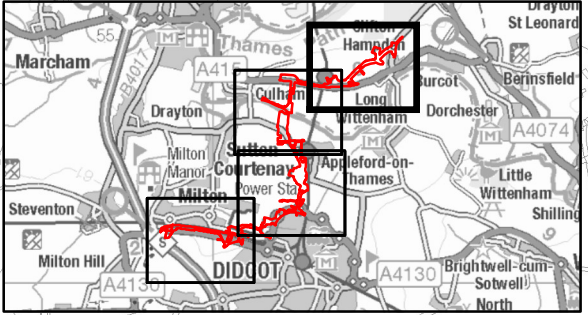
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- Indicative Red Line Boundary (Subject to Change)
- Indicative HIF 1 Highway Design (Subject to Change)
- Breeding Bird Territory:
 - Red Kite (KT)

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Drawing Title				
FIGURE 3C BREEDING BIRD SURVEY WCA SCHEDULE 1 SPECIES SHEET 4				
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Originator	Location	Role		



Appendix A Desk Study Records

Table A-1: Records of protected or notable species returned from the desk study

Species (English Name)	Scientific Name	Designation
Arctic Tern	<i>Sterna paradisaea</i>	BD1, BAmb
Avocet	<i>Recurvirostra avosetta</i>	BD1, WCA1i, BAmb
Barn Owl	<i>Tyto alba</i>	WCA1i
Barnacle Goose	<i>Branta leucopsis</i>	BD1, BAmb
Bar-tailed Godwit	<i>Limosa lapponica</i>	BD1, BAmb
Bearded Tit	<i>Panurus biarmicus</i>	WCA1i
Bewick's Swan	<i>Cygnus columbianus</i>	BD1, UKBAP, WCA1i, BAmb
Bittern	<i>Botaurus stellaris</i>	BD1, Section 41, UKBAP, WCA1i, BAmb
Black-headed Gull	<i>Chroicocephalus ridibundus</i>	BAmb
Black-tailed Godwit	<i>Limosa limosa</i>	WCA1i, BRed
Brambling	<i>Fringilla montifringilla</i>	WCA1i
Bullfinch	<i>Pyrrhula pyrrhula</i>	Section 41, UKBAP, BAmb
Caspian Gull	<i>Larus cachinnans</i>	BAmb
Cetti's Warbler	<i>Cettia cetti</i>	WCA1i
Common Crossbill	<i>Loxia curvirostra</i>	WCA1i
Common Gull	<i>Larus canus</i>	BAmb
Common Sandpiper	<i>Actitis hypoleucos</i>	BAmb
Common Tern	<i>Sterna hirundo</i>	BD1, BAmb
Corn Bunting	<i>Emberiza calandra</i>	Section 41, UKBAP, BRed
Cuckoo	<i>Cuculus canorus</i>	Section 41, UKBAP, BRed
Curlew	<i>Numenius arquata</i>	Section 41, UKBAP, BRed
Dunlin	<i>Calidris alpina</i>	BAmb
Dunnock	<i>Prunella modularis</i>	Section 41, UKBAP, BAmb
Fieldfare	<i>Turdus pilaris</i>	WCA1i, BRed
Firecrest	<i>Regulus ignicapilla</i>	BD1
Gadwall	<i>Anas strepera</i>	BAmb
Garganey	<i>Anas querquedula</i>	WCA1i, BAmb
Glaucous Gull	<i>Larus hyperboreus</i>	BAmb
Golden Plover	<i>Pluvialis apricaria</i>	BD1
Goldeneye	<i>Bucephala clangula</i>	WCA1i, BAmb
Grasshopper Warbler	<i>Locustella naevia</i>	Section 41, UKBAP, BRed
Great Black-backed Gull	<i>Larus marinus</i>	BAmb
Green Sandpiper	<i>Tringa ochropus</i>	WCA1i, BAmb
Greenshank	<i>Tringa nebularia</i>	WCA1i, BAmb

Species (English Name)	Scientific Name	Designation
Grey Partridge	<i>Perdix perdix</i>	Section 41, UKBAP
Grey Wagtail	<i>Motacilla cinerea</i>	BRed
Greylag Goose	<i>Anser anser</i>	BAmb
Hen Harrier	<i>Circus cyaneus</i>	BD1, Section 41, UKBAP, WCA1i
Herring Gull	<i>Larus argentatus</i>	BRed
Hobby	<i>Falco subbuteo</i>	WCA1i
House Martin	<i>Delichon urbicum</i>	BAmb
House Sparrow	<i>Passer domesticus</i>	Section 41, UKBAP, BRed
Iceland Gull	<i>Larus glaucooides</i>	BAmb
Kestrel	<i>Falco tinnunculus</i>	BAmb
Kingfisher	<i>Alcedo atthis</i>	BD1, WCA1i
Lapwing	<i>Vanellus vanellus</i>	Section 41, UKBAP, BRed
Lesser Black-backed Gull	<i>Larus fuscus</i>	BAmb
Lesser Redpoll	<i>Acanthis cabaret</i>	Section 41, UKBAP, BRed
Linnet	<i>Linaria cannabina</i>	Section 41, UKBAP, BRed
Little Egret	<i>Egretta garzetta</i>	BD1
Little Gull	<i>Hydrocoloeus minutus</i>	BD1, WCA1i
Little Ringed Plover	<i>Charadrius dubius</i>	WCA1i
Mallard	<i>Anas platyrhynchos</i>	BAmb
Marsh Tit	<i>Poecile palustris</i>	Sect.41, UKBAP, BRed
Meadow Pipit	<i>Anthus pratensis</i>	BAmb
Mediterranean Gull	<i>Larus melanocephalus</i>	BD1, WCA1i, BAmb
Mistle Thrush	<i>Turdus viscivorus</i>	BRed
Mute Swan	<i>Cygnus olor</i>	BAmb
Nightingale	<i>Luscinia megarhynchos</i>	BRed
Nightjar	<i>Caprimulgus europaeus</i>	BD1, Section 41, UKBAP, BAmb
Osprey	<i>Pandion haliaetus</i>	BD1, WCA1i
Oystercatcher	<i>Haematopus ostralegus</i>	BAmb
Peregrine	<i>Falco peregrinus</i>	BD1, WCA1i
Pied Flycatcher	<i>Ficedula hypoleuca</i>	BRed
Pintail	<i>Anas acuta</i>	BAmb
Pochard	<i>Ficedula hypoleuca</i>	BRed
Red Kite	<i>Milvus milvus</i>	BD1, WCA1i
Redshank	<i>Tringa totanus</i>	BAmb
Redstart	<i>Phoenicurus phoenicurus</i>	BAmb

Species (English Name)	Scientific Name	Designation
Redwing	<i>Turdus iliacus</i>	WCA1i, BRed
Reed Bunting	<i>Emberiza schoeniclus</i>	Section 41, UKBAP, BAmb
Ruff	<i>Calidris pugnax</i>	BD1, WCA1i, BRed
Shelduck	<i>Tadorna tadorna</i>	BAmb
Shoveler	<i>Anas clypeata</i>	BAmb
Skylark	<i>Alauda arvensis</i>	Section 41, UKBAP, BRed
Snipe	<i>Gallinago gallinago</i>	BAmb
Smew	<i>Mergellus albellus</i>	BD1, BAmb
Song Thrush	<i>Turdus philomelos</i>	Section 41, UKBAP, BRed
Spotted Crake	<i>Porzana porzana</i>	BD1, WCA1i, BAmb
Starling	<i>Sturnus vulgaris</i>	Section 41, UKBAP, BRed
Stock Dove	<i>Columba oenas</i>	BAmb
Swift	<i>Apus apus</i>	BAmb
Tawny Owl	<i>Strix aluco</i>	BAmb
Teal	<i>Anas crecca</i>	BAmb
Tree Sparrow	<i>Passer montanus</i>	Section 41, UKBAP, BRed
Whimbrel	<i>Numenius phaeopus</i>	WCA1i, BRed
Whooper Swan	<i>Cygnus cygnus</i>	BD1, WCA1i, BAmb
Wigeon	<i>Anas penelope</i>	BAmb
Willow Warbler	<i>Phylloscopus trochilus</i>	BAmb
Wood Sandpiper	<i>Tringa glareola</i>	BD1, WCA1i, BAmb
Woodcock	<i>Scolopax rusticola</i>	BRed
Wryneck	<i>Jynx torquilla</i>	UKBAP, WCA1i
Yellow Wagtail	<i>Motacilla flava</i>	Section 41, UKBAP, BRed
Yellowhammer	<i>Emberiza citrinella</i>	Section 41, UKBAP, BRed
Yellow-legged Gull	<i>Larus michahellis</i>	BAmb
* BD1 - Annex 1 of the EU Birds Directive; Section 41 - NERC Species of Principal Importance; UKBAP – UK Biodiversity Action Plan priority bird species; BRed & BAmb – Birds of Conservation Concern Red and Amber list species; WCA1i – Schedule 1 of the WCA bird species.		

Annex 9 – Appendix 9.11: Otter and Water Vole Survey Report



REVISED

Didcot Garden Town HIF 1 Scheme

Environmental Statement

Volume III

Appendix 9.11: Otter and Water Vole Survey Report

October 2022

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Executive Summary

AECOM was instructed by Oxfordshire County Council (the client) to undertake surveys of riparian mammals, including European Otter (*Lutra lutra*) (subsequently referred to as just Otter) and Water Vole (*Arvicola amphibius*) for the proposed Didcot Garden Town HIF 1 Scheme (hereafter referred to as the 'Scheme').

Otter and Water Vole are both fully protected under Schedule 5 of the Wildlife & Countryside Act 1981 (as amended). Otter is also classified under the Habitats Directive (92/43/EEC) as a species requiring strict protection in Europe. Any operations that may impact upon Otters or their places of rest or shelter will require a Natural England European Protected Species Licence (EPSL).

Aerial photographs, 1:25,000 Ordnance survey maps of the Site and information gathered during the Preliminary Ecological Appraisal survey were used to identify riparian and wetland habitats within an appropriate buffer either side of the Site and this information was used to refine the survey area for Otter and Water Vole. In total, there were 13 watercourses and waterbodies within the survey area that were subject to a habitat suitability assessment for Otter and Water Vole. One of these, Moor Ditch was split into seven survey sections. Of these 13 watercourses, five were identified as potentially suitable for Otter and four were identified as potentially suitable for Water Vole.

The Otter surveys identified the presence of Otter in the River Thames with up to three animals recorded during camera trapping surveys and evidence being found in the form of spraints and feeding remains, but no sightings or recordings of Otter were made in Moor Ditch. Both the River Thames and Moor Ditch are crossed by the Scheme.

No evidence of Water Vole was found during surveys within the Site, or in adjacent riparian habitats. However, good Water Vole habitat was recorded within two watercourses in the wider area alongside data search records of Water Vole.

Any impacts upon Otter and Water Vole, should the latter move into the Site arising as a result of construction or operation of the Scheme, could have a potentially significant adverse impact. Therefore, through the implementation of a mitigation strategy, formalised through a Construction and Environment Management Plan (CEMP), the potential for deliberate harm and injury to Otter and Water Vole, should the latter move into the Site will be avoided.

A number of measures have been included within this report to minimise any potential impacts on Otter and Water Vole (see Section 6). Furthermore, camera-trapping surveys are recommended to determine the extent of use of Otter resting sites (which are protected under legislation) along the Moor Ditch and the River Thames, to determine whether further mitigation will be required.

1. Introduction

1.1 Background

- 1.1.1 The Preliminary Ecological Appraisal (PEA) (AECOM, 2020¹) for the proposed Didcot Garden Town HIF1 Scheme (hereafter referred to as the Scheme), undertaken in January 2020, identified that the habitat within the Scheme boundary (the Site) was suitable to support European Otter (*Lutra lutra*) (subsequently referred to as just Otter) and Water Vole (*Arvicola amphibius*). Therefore, AECOM was instructed by Oxfordshire County Council (the client) to undertake surveys of riparian mammals for the Scheme, to determine the presence or absence of Otter and, or, Water Vole within the Scheme boundary (the Site) and an appropriate survey buffer (referred to hereafter as the survey area).
- 1.1.2 Camera traps were deployed on specific locations along two watercourses (Moor Ditch and the River Thames), crossed by the Scheme, that potentially supported Otter, to determine the frequency of use by Otter and classify areas appropriately for their use (e.g. holts, couches and resting sites (see Section 3.2.7)). The survey information from camera trapping was used to inform any specific appropriate mitigation for Otter.
- 1.1.3 The information described in this report provides a complete baseline which will be used to inform the Ecological Impact Assessment (EclA) and reported in the Environmental Statement for the Scheme.

1.2 The Scheme

- 1.2.1 The Scheme is located to the west and north of Didcot, Oxfordshire, between the Milton Interchange Service Area in the west (at OS grid reference SU483913), and the B4015 north-east of the village of Clifton Hampden (at OS grid reference SU548962).
- 1.2.2 The Scheme comprises the following four improvement sites (see Figure 1):
- A4130 Widening, which will dual the existing road between Milton Gate and the new Didcot Science Bridge, with several new junctions into adjacent proposed developments;
 - Didcot Science Bridge, a new bridge over the Great Western Railway Mainline and a new link road through the former Didcot A Power Station site, re-joining the A4130 Northern Perimeter Road north of the Purchas Road/Hawksworth roundabout;
 - Didcot to Culham River Crossing, providing a new road connecting the A4130 at Didcot with the A415 at Culham, including a bridge over the River Thames and another bridge over a private rail line, and connections to Appleford and Sutton Courtney via B4016; and
 - Clifton Hampden Bypass, a new relief road north of the village, between the A415 at Culham Science Centre and the B4015 Oxford Road, north of Clifton Hampden.

1.3 Site Descriptions

- 1.3.1 The land use within the Site is a mixture of agricultural land, with an active power station site, an old power station site (Didcot A Power Station) currently undergoing

¹ AECOM. (2020). Didcot Garden Town Preliminary Ecological Appraisal.

redevelopment, an industrial estate, a live landfill site and a quarry. Multiple waterbodies are also present within the Site and the survey area.

- 1.3.2 A summary description of the habitats within the Site is provided below and a more detailed description of the habitats is provided in the PEA report (AECOM, 2020²). The Scheme layout is presented in Figure 1.

A4130 Widening

- 1.3.3 This part of the Scheme comprises a dual-carriageway from a point approximately 250 m east of Milton Interchange at the junction with Milton Gate, eastwards for approximately 1.6 km to the proposed eastern roundabouts connecting into the future development at Valley Park and the Didcot Science Bridge scheme. Dualling of the A4130 will consist of modifications to the existing single carriageway, establishment of a central reserve and provision of two additional lanes to the south. The existing single carriageway will form the eastbound carriageway towards Didcot and the newly constructed lanes will form the westbound carriageway to the A34 Milton Interchange.
- 1.3.4 A four-arm roundabout at the western end of the scheme is proposed to serve an area located immediately south-west of this roundabout, which has been subject to approved outline development proposals for Roadside Services and Facilities (planning application reference P15/V2880/O). This Backhill roundabout will also provide access to the North West of Valley Park strategic housing allocation site, to the south and east.
- 1.3.5 A new signalised T-junction is proposed approximately 600 m east of the Backhill roundabout which will provide access to the 'Valley Park' strategic housing allocation site, which is the subject of an outline planning application P14/V2873/O, with a resolution to grant permission subject to Section 106 agreement.
- 1.3.6 A new three-arm Old A4130 roundabout is proposed 600 m east of the signalised junction. The eastern arm will be the current A4130, that is to be retained as a single carriageway, providing access into Didcot. The southeastern arm is proposed to be an approximately 260 m single carriageway road connecting to the new Didcot Science Bridge three-arm roundabout. The Didcot Science Bridge roundabout will provide access to the new Didcot Science Bridge to the north, and Valley Park housing development to the south. Access at this location is already being secured through the outline planning application for Valley Park.
- 1.3.7 The road corridor will also include a bi-directional segregated cycleway and a footway on the southern side of the dual carriageway, as well as several formal crossing points and buffer.

Didcot Science Bridge

- 1.3.8 This section of the proposed scheme is a new north-south bridge from the proposed Didcot Science Bridge roundabout, over the existing A4130, the Great Western Railway Mainline, and Milton Road, into the former Didcot A Power Station site. The proposed Science Bridge Link Road (SBLR) will connect the bridge with the A4130 Northern Perimeter Road north of the Purchas Road/Hawksworth roundabout, close to the existing Southmead Industrial Estate.
- 1.3.9 Planning permission (P15/S1880/O and P15/V1304/O) has been granted for a mixed-use development in the power station site and this includes the reservation of land for the SBLR and Didcot Science Bridge. There will be various embankments associated with the road bridge approaches, and they will vary in width. The road

² AECOM. (2020). Didcot Garden Town Preliminary Ecological Appraisal.

bridge will be approximately 16 m in width, including a single carriageway, a bi-directional segregated cycleway and a footway on one side of the road.

- 1.3.10 The SBLR will be a single carriageway, with segregated footways and bi-directional cycleways on both sides of the road for the majority of its length. Various accesses are planned off the road alignment for the proposed development in the power station site (P15/S1880/O and P15/V1304/O). Other works required include the diversion of a watercourse which will cross underneath the new road in a culvert, and provision of formal Non-Motorised User (NMU) crossings, including a toucan crossing where a National Cycle Route crosses the road alignment.

Didcot to Culham River Crossing

- 1.3.11 This section of the Scheme will provide a new 3.6 km single carriageway link road west of the Cherwell Valley railway line and NMU facilities between Didcot and Culham. It will extend north from the A4130 Collett roundabout in Didcot to the A415 Abingdon Road west of Culham Science Centre.
- 1.3.12 An improved and enlarged four-arm A4130 Collett roundabout will be provided. This will connect with the Didcot Science Bridge scheme to the west, the Didcot to Culham Link Road to the north, Southmead Industrial Estate to the south and to the existing A4130 to the east.
- 1.3.13 Agricultural land, private residential properties, a pallet and wood recycling centre, Sutton Courtenay landfill, and Hanson aggregate operations all lay north of Collett roundabout. A Local Development Order is being prepared to enable this agricultural area to become an employment site called D-Tech, in this Didcot Growth Accelerator Enterprise Zone.
- 1.3.14 North of Collett roundabout to the southern edge of Sutton Courtenay Landfill the new single carriageway road will be approximately 20 m wide with verges, hard strips, and segregated footways and bi-directional cycleways on both sides. Two accesses, one on either side of the proposed road, will be provided to maintain access to the adjacent agricultural land, private residential properties and businesses.
- 1.3.15 The road will extend north along the east edge of Sutton Courtenay Landfill. In this area on the west side of the road a 3.0 m shared use bridleway is provided with the segregated footways and bi-directional cycleways continuing on the east side. On the west side of the road a new priority junction and access road will be provided to Sutton Courtenay Landfill (operated by FCC Environment), and Hanson Aggregates and Appleford Railway Sidings (operated by Hanson). This will replace the existing Portway Road access further north.
- 1.3.16 The road extends north to Appleford railway sidings passing along the eastern boundary of a large surface water management pond. The Cherwell Valley Line and Appleford Level Crossing is located to the east of the proposed road. Appleford Sidings bridge will be provided to bridge the road over the railway sidings and connect the north and south approach embankments.
- 1.3.17 The road will traverse 90 Acre Field, an area of restored historic landfill, and link to the B4016 to the west of Appleford. A priority T-junction with a ghost island right turn lane will be provided at this location. Sutton Courtenay roundabout will be provided to the north-west with a severed section of the B4016 retained to be a footway cycleway. Sutton Courtenay roundabout will be an at grade, three-arm roundabout providing access to the crossing over the River Thames whilst maintaining links between Appleford, Sutton Courtenay and the surrounding areas.

- 1.3.18 Extending north from Sutton Courtenay roundabout, a 336-metre approach viaduct will be provided to cross the River Thames flood plain with a 155 m bridge provided to span over the River Thames. The River Thames is navigable at this location the bridge height has been designed to accommodate river traffic.
- 1.3.19 North of the River Thames, the new link road will continue north through existing agricultural land towards A415 where a new at grade four-arm roundabout will be constructed to connect with the A415 and a new development to the north which is an allocated site in the Local Plan.

Clifton Hampden Bypass

- 1.3.20 The Clifton Hampden Bypass will re-route traffic on the A415 around the village of Clifton Hampden, which currently experiences a large amount of through traffic as people travel between the A415 to A4074 northwest of the village.
- 1.3.21 The link road will provide a bypass northwest of Clifton Hampden village and will be approximately 2.2 km long. The new road will be a single carriageway with adjacent hard strips, grass verges, and a shared-use cycleway / footway. The bypass will be aligned in a south-west to north-east direction and will be a single carriageway, approximately 9.3 m in width including hard strips.
- 1.3.22 The proposed works also include the construction of a large four-arm roundabout at the western end of the Scheme, providing access to the SODC Local Plan allocated housing site, a railway station and Leda Properties owned farmland / businesses north of Culham Science Centre (CSC) coming off the northern arm, and CSC on the north-east arm. A new T-junction with a ghost island right turn lane connecting the existing B4015 Oxford Road is proposed at the eastern extent of the Scheme.
- 1.3.23 The current alignment of the A415 will be realigned north into the proposed bypass, with the existing A415 west of this point as a “no through road” to serve existing residences. All roundabout exits will include one lane, except the eastern bypass arm which will have two lanes. The roundabout will have a segregated left turn lane from the eastern bypass arm to the western A415 arm.
- 1.3.24 Station Road will be realigned and will join with a new entrance to the industrial properties located northwest of the roundabout. The existing main access into the CSC will be converted into a shared use footway / cycleway. The northeast roundabout arm will provide access to CSC via the main gate, and a stub towards Perimeter Road for a potential future connection to be delivered by CSC.
- 1.3.25 The A415 connection road east of the roundabout will provide access from the bypass to the existing A415 and Clifton Hampden.
- 1.3.26 Along the bypass, four access points will be included on the south side of the road; one will link to the existing alignment of the A415 (as described); one to a Thames Water sewage treatment works; and one to an existing farm track. The bypass will tie-in with the current alignment of the B4015 Oxford Road (east) and a T-junction with a ghost island right turn will be included, to provide access to the current alignment of the B4015 Oxford Road (south-west).
- 1.3.27 On the north side of the road, two accesses will be created; one will be a new second access into the CSC, the other will link with an existing farm track.

1.4 Scope of the Report

1.4.1 The objective of the riparian mammal surveys, reported in this document, was to determine the presence or likely absence of Otter and, or, Water Vole within the survey area.

1.4.2 This report includes the following information:

- relevant legislation and policy;
- methods for desk and field-based assessments;
- limitations to the surveys undertaken and any assumptions made as a result of incomplete data;
- survey results;
- evaluation of the status and importance of the survey area and the Site for Otter and Water Vole; and
- conclusions and potential constraints.

2. Legislative and Policy Framework

2.1.1 Otter and Water Vole are both fully protected under Schedule 5 of the Wildlife & Countryside Act 1981³ (as amended). They are afforded protection under Section 9 parts 9(1) (2) (4) and (5) of the Act, making it an offence to:

- intentionally kill, injure or take these species;
- possess or control live or dead individuals of these species or their derivatives;
- intentionally or recklessly damage, destroy or obstruct access to any structure or place used for their shelter or protection;
- intentionally or recklessly disturb these species whilst occupying a structure or place of shelter used for that purpose;
- sell these species or offer or expose for sale or transport for sale; and
- publish or cause to be published any advertisement which conveys the buying or selling of these species.

2.1.2 Otter is also classified under the Habitats Directive (92/43/EEC⁴) as a species requiring strict protection in Europe. In the UK, this is enabled by the Conservation of Habitats and Species Regulations 2017⁵ (as amended). Otter is also included in the following international legislation/conventions:

- Appendix II and IV of the Habitats Directive, Appendix II of the Bern Convention⁶ and Appendix I of CITES⁷; and
- Globally threatened on the IUCN/WCMC Red Data List (Roos *et al.*, 2015⁸).

2.2 Licencing Requirements

2.2.1 A licence is required from Natural England to intentionally damage or destroy Water Vole burrows or displace Water Voles from their burrows for lawful development. Any operations that may impact upon Otters or their places of rest or shelter will require a Natural England European Protected Species (EPS) licence. There is no provision for licencing development or other construction activities under the Wildlife and Countryside Act. Such works should therefore be undertaken under a conservation licence. This licence requires demonstration of a conservation benefit for Otter and Water Vole and this benefit can be achieved by delivering a net gain in the amount of habitat available to Otter and Water Vole populations.

2.2.2 No licence is required to conduct an Otter survey assuming that care is taken to avoid disturbance of potential couches and holt locations. No survey that will result in disturbance of Otter or their places of rest was undertaken as part of the current survey. Where monitoring or confirmation of holts is required, non-invasive techniques such as the use of appropriately placed infra-red cameras and or camera traps will be utilised.

2.2.3 No survey licence is required to undertake Water Vole surveys.

³ Anon. (1981). The Wildlife & Countryside Act. HMSO, London.

⁴ Anon. (1992). Council Directive 92/43/EEC. HSMO, London.

⁵ Anon. (2017). The Conservation of Habitats and Species Regulations 2017. HMSO

⁶ Anon. (2001). Appendices of the Convention and Amendments to the Appendices. Bern Convention. Council of Europe

⁷ Anon. (2020). Appendices I, II and III. CITES

⁸ Roos, A., Loy, A., de Silva, P., Hajkova, P. & Zemanová, B. 2015. *Lutra lutra*. The IUCN Red List of Threatened Species 2015: e.T12419A21935287. <http://dx.doi.org/10.2305/IUCN.UK.2015-2.RLTS.T12419A21935287.en>. Downloaded on 05 December 2017.

2.3 Priority Species

- 2.3.1 The Natural Environment and Rural Communities (NERC) Act lists Species of Principal Importance⁹ which is used to guide decision-makers such as public bodies, including local and regional authorities, in implementing their duty under Section 40 of the NERC Act (2006); under Section 40 every public authority (e.g. a local authority or local planning authority) must, in exercising its functions, have regard, so far as is consistent with the proper exercise of those functions, to the purpose of conserving biodiversity.
- 2.3.2 In addition, with regard to those species on the list of Species of Principal Importance listed under Section 41 (S41), the Secretary of State must:
- “(a) take such steps as appear to the Secretary of State to be reasonably practicable to further the conservation of the living organisms and types of habitat included in any list published under this section, or*
- (b) promote the taking by others of such steps.”*
- 2.3.3 The UK Biodiversity Action Plan (UKBAP)¹⁰ was launched in 1994 and established a framework and criteria for identifying species of conservation concern. From this list, action plans for priority species of conservation concern were published and have subsequently been succeeded by the UK Post-2010 Biodiversity Framework (July 2012)¹¹. The UK Post 2010 Development Framework is relevant in the context of Section 40 of the NERC Act 2006, meaning that Priority Species are material considerations in planning. These species are identified as those of conservation concern due to their rarity or a declining population trend.
- 2.3.4 Water Vole and Otter are included as a priority species under Section 41 of the NERC Act 2006.

2.4 Local Biodiversity Action Plan Species

- 2.4.1 No specific species action plans are listed within the Oxfordshire Biodiversity Action Plan, instead, a list of all UK BAP priority species found within Oxfordshire is provided on the Oxfordshire Nature Conservation Forum (ONCF) website (ONCF, 2010^{12,13}).

⁹ Natural Environment and Rural Communities Act (2006). [Available at: <http://publications.naturalengland.org.uk/publication/4958719460769792>]

¹⁰ JNCC. (1994). UK Biodiversity Action Plan

¹¹ JNCC, (2012). 'UK Post-2010 Biodiversity Framework'.

¹² Oxfordshire Nature Conservation Forum. (2010a). Oxfordshire's Biodiversity Action Plan and Conservation Target Areas. Available at:

<https://www2.oxfordshire.gov.uk/cms/sites/default/files/folders/documents/environmentandplanning/countryside/naturalenvironment/BAPnewsletterFINAL.pdf> [Accessed April 2020]

¹³ Oxfordshire Nature Conservation Forum. (2010b). Biodiversity. Available at: <http://www.oncf.org.uk/biodiversity/biodiversity.html> [Accessed April 2020].

3. Methods

3.1 Desk Study

- 3.1.1 A data search was carried out in December 2019, through Thames Valley Environmental Records Centre (TVERC), to obtain records of Otter and Water Vole within a 2 km radius of the Site and from within the last ten years of the request date.
- 3.1.2 Only records up to ten years old were considered within the assessment, as any records older than ten years are unlikely to be still representative of Otter and Water Vole in the local area.

3.2 Field Survey

- 3.2.1 Aerial photographs of the Site, 1:25,000 Ordnance Survey maps and information gathered during the PEA survey¹⁴ were used to identify riparian and wetland habitats within an appropriate buffer either side of the Site and this information was used to refine the survey area for Otter and Water Vole. A walkover of the survey area was then undertaken by an experienced surveyor to locate the features identified and if still present, undertake a habitat suitability assessment for Otter and Water Vole.
- 3.2.2 Watercourses and waterbodies that were:
- identified during the habitat suitability assessment as being dry;
 - in heavy agricultural use with no marginal vegetation;
 - impacted by significant barriers to movement between the waterbody or watercourse and the Site; and
 - no suitable for Otter or Water Vole
- 3.2.3 were scoped out from further survey. This assessment was made with reference to the criteria presented in Table 3-1.

Table 3.1 Summary of riparian mammal habitat suitability assessment criteria

Otter	Water Vole
<ul style="list-style-type: none"> • proximity to the Site; • presence of barriers to dispersal and movement through the territory; • habitats present and suitability for use by Otter (including terrestrial habitats); • adjoining land use; • level of disturbance; • features of watercourse or waterbody (estimated depth, level of flow, width of channel); • connectivity with other areas of suitable or sub-optimal habitat; and • pollution. 	<ul style="list-style-type: none"> • rate of water flow; • bank profile; • degree of shading from overhanging trees or scrub; • extent of suitable emergent and bankside herbaceous vegetation for shelter, food and nesting material; • levels of site disturbance (e.g. proximity to public rights of way, farm vehicle access tracks or road traffic); • potential for the waterbody or watercourse to dry out; • suitability of bank substrates for burrowing; and • pollution and water quality.

¹⁴ AECOM (2020) Preliminary Ecological Appraisal

Otter Survey

- 3.2.4 The aim of the survey was to determine the presence or absence of Otter on those waterbodies and watercourses deemed suitable for Otter following the habitat suitability assessment. The methodology used was in accordance with guidance in the New Rivers and Wildlife Handbook (RSPB, NRA & RSNC, 1994¹⁵); the Environment Agency's Fifth Otter Survey of England 2009-2010 (Environment Agency, 2010¹⁶), 'Monitoring the Otter' (Chanin, 2003¹⁷) and with reference to The Design Manuals for Roads and Bridges (DMRB) Vol 10 Section 4 Part 4.
- 3.2.5 Otter surveys can be carried out at any time of year, though the period May to September is optimal when water levels are less variable. Surveys should not be undertaken following periods of heavy rain and, or, high-water levels as it can obscure or remove signs of Otter and result in false negative survey results. Ideally, there should be a period of at least five days without rain before surveying.
- 3.2.6 Within the survey area, two surveys were undertaken on waterbodies and watercourses, between May and September 2020. Given, the Scheme proposes a major new crossing of the River Thames, in line with DMRB guidelines, the River Thames was subject to four surveys in total, including one by boat, between April and September 2020. Otter may use different areas at different times of the year and therefore this was considered during survey.
- 3.2.7 The areas surveyed were mapped along with the positions and densities of spraint, holts, couches and other field signs of Otter. Surveys were undertaken by experienced AECOM ecologists.
- 3.2.8 Due to the low likelihood of observing an Otter, the survey concentrated on locating field signs which indicate Otter presence. Such signs include:
- Spraints (droppings) – characteristic sweet-smelling, black tar-like (where fresh/relatively recent *i.e.* within a few weeks) or grey crumbly (when old) faecal deposits usually containing fish scales, bones and occasionally invertebrate exoskeleton and bird feathers.
 - footprints – in good substrate typically asymmetrical and showing five toes arched around a large pad and, depending on substrate, webbing and claw marks. Poorer, generally coarser substrates do not often enable the identification of Otter footprints. Additional signs of Otter presence may occur, although without additional evidence is not usually conclusive proof of current Otter presence.
 - feeding remains – feeding remains may include partially eaten fish, frogs, piles of mussel shells or crayfish remains.
 - slides/haul-outs – Routes into and out of the water, which are usually associated with terrestrial routes such as short cuts around meanders or along traditionally used Otter paths/routes.
 - couches/hovers – above ground resting place. These are usually associated with cover such as dense scrub, rushes or reed, flood debris or fallen trees. Many couches are rarely used whilst others more so. Difficult to prove use without radio tracking.
 - holts – below ground resting site, usually associated with spraints. Can be important for breeding (natal holts) where other signs are usually absent. Notoriously difficult to find or prove without radio tracking.

¹⁵ RSPB, NRA and RSNC (1994). The New Rivers & Wildlife Handbook. RSPB.

¹⁶ Environment Agency, (2010). Fifth Otter Survey of England 2009-2010. Technical Report. Environment Agency.

¹⁷ Chanin, P (2013) Otters. The British Natural History Collection. Whittet Books

Water Vole Survey

- 3.2.9 Water Voles typically inhabit slow-moving streams, canals, ditches, dykes and rivers, feeding mostly on waterside vegetation. They are active in daylight hours and leave several indications of their presence and these signs can be used to identify the presence of Water Vole and, by quantifying the presence of certain signs, can be used to estimate the population size.
- 3.2.10 Field surveys were based on the standard methodologies as described by Strachan *et al.* (2011¹⁸) in the 'Water Conservation Handbook' and Dean *et al.* (2016²²), in "The Water Vole Mitigation Handbook".
- 3.2.11 All suitable waterbodies and watercourses within 50 m either side of the Site were surveyed for Water Voles, where access allowed, with the survey area extended out to 500 m upstream and downstream where the Site crossed a watercourse (such as the River Thames).
- 3.2.12 In accordance with the guidance set out in Water Vole Mitigation Handbook (2016¹⁹), one survey was conducted in the first half of the breeding season (April to June) and a second survey was carried out in the second half of the breeding season (July to September). All surveys were conducted during suitable weather conditions and by experienced AECOM ecologists.
- 3.2.13 The Water Vole survey involved identification of evidence of Water Vole activity up to 5 m from the bank of the surveyed waterbodies and watercourses. All evidence of Water Vole was recorded and for each watercourse a standard survey form was completed.
- 3.2.14 Field signs for Water Vole included:
- latrine sites – distinct piles of Water Vole droppings found near nest sites, at the ranges of territorial boundaries and where the animals enter and leave the water;
 - feeding stations – areas with distinct neat piles of chewed lengths of vegetation along pathways or haul out platforms along the water's edge;
 - burrows – above and below water with a cropped "garden" or "lawn" around the burrow entrance. Burrow entrances are typically wider than they are high, with a diameter between 4 and 8 cm;
 - paths and runs – along the water's edge, low tunnels that are pushed through the vegetation and footprints in soft mud, often leading to the burrows or feeding stations; and
 - sightings – observations of animals or sounds ('plops') entering the water.
- 3.2.15 Any information gathered during the survey on Water Vole signs was used to calculate and estimate Water Vole population and, or activity within those specific waterbodies or watercourse. The presence or absence of American Mink (*Mustela vison*) and Brown Rat (*Rattus norvegicus*) was also recorded if the species or signs of their presence were noted.

Camera Trap Survey

- 3.2.16 Camera traps were installed from 12th May to the 11th June 2021 in two locations where high levels of Otter had been identified during the Preliminary Ecological

¹⁸ Strachan, R, Moorhouse, Y & Gelling, M. (2011) The Water Vole Conservation Handbook (Third Edition).

¹⁹ Dean, M, Strachan, R, Gow, D, Andrews, R (2016). The Water Vole Mitigation Handbook (The Mammal Society Mitigation Guidance Series). Eds. Fiona Mathews and Paul Chanin. The Mammal Society. London.

Appraisal surveys in 2020. These camera traps were subsequently checked for any recordings which may have included any evidence of Otter using these areas.

3.3 Limitations

- 3.3.1 There were limitations to surveying some sections of some of the larger waterbodies due to the presence or likely absence of Otter and Water Vole due to the depth of water and bank profiles. These presented significant health and safety risks. However, whilst undertaking other ecological surveys on these waterbodies (such as surveys for Great Crested Newt *Triturus cristatus*), these waterbodies were spot-checked for evidence of Otter and Water Vole which was considered sufficient in determining presence, or likely presence, of either species.

Otter

- 3.3.2 The DMRB guidance requires that any watercourse connected to the Site and identified as potentially affected by the Scheme should be surveyed for 2 km either side of the Site (where access allows) and that surveys of each suitable feature should be conducted at 3-month intervals over a period of one year to account for seasonal variations within Otter activity (four visits in total). However, given the poor quality and low suitability for Otter of the majority of watercourses within the Site and connected to the Site, two survey visits (covering spring and autumn) were sufficient to inform the ecological assessment.
- 3.3.3 Surveys of the River Thames commenced in April 2020, rather than earlier in the year, due to high water levels during winter months. This did not have a negative impact upon the efficacy of the survey as signs of Otter would have been difficult to find during periods of high water and heavy rainfall. Furthermore, four survey visits were undertaken along the River Thames, once the water levels had settled and were distributed throughout the aforementioned survey period.
- 3.3.4 Within the survey area, WB08 (see Figure 3a) was surveyed only once for Otter due to access being granted late in the survey season. This is not a significant limitation as WB08 is situated in close proximity to WB07 and WB09 (Figure 3a), which, along with the results for WB08 single autumn survey, can be used to inform on Otter presence or absence and a precautionary approach, assuming presence, will be taken where the habitat quality is considered as optimal.

Water Vole

- 3.3.5 It was not possible to survey the entire margins of watercourse WB13 for Water Vole, due to the depth of the watercourse and presence of dense vegetation. However, this was not a significant limitation as the watercourse had areas of clearer vegetation where surveyors could effectively survey. Furthermore, the habitat quality of these areas and presence of Water Vole in adjacent habitats and stretches of the watercourses has been used to inform on the presence or likely absence in these areas and a precautionary approach, assuming presence, will be taken where the habitat quality is considered as optimal for Water Vole.
- 3.3.6 WB03 was considered unsuitable for Water Vole, owing to shallow water and heavy shading from bankside trees and vegetation. However, this watercourse was surveyed twice in autumn as a precaution, to confirm absence of this species.

4. Results

4.1 Desk Study

- 4.1.1 The data search returned 88 records of Otter and 45 records of Water Vole within 2 km of the Site and from within ten years of the request date (Figure 2). Thirty-one records of Otter were returned from the River Thames in 2015. The closest record for Otter was found within the Site, on the northern bank of the River Thames.
- 4.1.2 The closest Water Vole record was returned within WB13 (as shown in Figure 3b), which is a ditch approximately 300 m north-east of the southern section of the Didcot to Culham River Crossing site. Furthermore, two Water Vole records were returned from within Sutton Courtenay Environmental Education Centre, located 500 m north of the A4130 Widening site.

4.2 Field Survey

Survey Area

- 4.2.1 In total, there were 13 watercourses and waterbodies within the survey area that were subject to a habitat suitability assessment for Otter and Water Vole. **One of these, Moor Ditch was split into seven survey sections.** Of these 13 watercourses, five were identified as potentially suitable for Otter and four were identified as potentially suitable for Water Vole. Therefore, these were subject to further surveys for Otter and Water Vole. A breakdown of the watercourses surveyed and the rationale for exclusion from survey (if applicable), are provided below in Table 4-1.
- 4.2.2 The location of all watercourses and waterbodies surveyed for Otter and Water Vole are presented in Figures 3a and 3b respectively.

Table 4.1 Summary of Otter and Water Vole habitat suitability assessment, including reason for exclusion from survey (where applicable)

Watercourse and Waterbody Reference (with reference to Figures 3a and 3b)	Within the Site	Scoped in for further assessment for Otter	Scoped in for further assessment for Water Vole	Reason for exclusion from any surveys	Photo Number (See Appendix B for site photographs)
River Thames	Yes	Yes	Yes	-	1
WB01	Yes	No	No	Watercourse was found to be almost dry in June and September. Deemed unsuitable for Water Vole and Otter.	-
WB02	Yes	No	No	Watercourse was found to be dry in June, unsuitable for Water Vole and Otter.	-
WB03	Yes	Yes	Yes	-	2
WB04	Yes	No	No	Watercourse found to be dry in July and September,	-

Watercourse and Waterbody Reference (with reference to Figures 3a and 3b)	Within the Site	Scoped in for further assessment for Otter	Scoped in for further assessment for Water Vole	Reason for exclusion from any surveys	Photo Number (See Appendix B for site photographs)
				unsuitable for Water Vole and Otter.	
WB05	Yes	No	No	Not accessible due to overgrown vegetation. Shallow stream, unlikely to be suitable for Water Vole and Otter.	-
WB06	Yes	No	No	Dense vegetation, very shaded. Deemed unsuitable for Water Vole and Otter.	-
Moor Ditch (Section WB07)	No	Yes	Yes	-	3
Moor Ditch (Section WB08)	No	Yes	No	Open concrete ditch – not suitable for Water Vole	4
Moor Ditch (Section WB09)	No	Yes	No	Open concrete ditch – not suitable for Water Vole	5
Moor Ditch (Section WB10)	Yes	Yes	Yes	-	6
Moor Ditch (Section WB11)	Yes	No	No	Watercourse found to be dry in June, unsuitable for Water Vole and Otter.	-
Moor Ditch (Section WB12)	No	Yes	No	Densely vegetated and heavily shaded – not suitable for Water Vole	7
Moor Ditch (Section WB13)	No	Yes	Yes	-	8
WB14	No	Yes	No	Outside of survey area for Water Vole.	9
WB15	Yes	Yes	Yes	-	10
WB16	Yes	No	No	Watercourse found to be dry in September, unsuitable for Water Vole and Otter.	-
WB17	Yes	No	No	Watercourse found to be dry in June, unsuitable for Water Vole and Otter.	-

Watercourse and Waterbody Reference (with reference to Figures 3a and 3b)	Within the Site	Scoped in for further assessment for Otter	Scoped in for further assessment for Water Vole	Reason for exclusion from any surveys	Photo Number (See Appendix B for site photographs)
WB18	No	No	No	Watercourse found to be dry in August, unsuitable for Water Vole and Otter.	-

Riparian Mammal Survey

Otter

- 4.2.3 The results of the Otter field surveys carried out for the five watercourses are presented below in Table 4-2. In summary, signs of Otter were recorded from three of these watercourses, but with no signs of Otter recorded from WB03 or WB15 (see Figure 3a). Where signs were found these are discussed in Section 5. Site photographs are presented in Appendix B. The location and type of Otter signs found within the survey area are presented in Figure 3a.

Table 4.2 Results of Otter field surveys undertaken within the survey area in 2020

Watercourse (see Figure 3a)	Habitat Description	Dates of Survey	Signs of Otter recorded? (Yes / No)
River Thames	The area surveyed comprised up to 2 km upstream (from Culham Tollgate Bridge) and 0.5 km downstream along the north and south banks of the River Thames. This section of the River Thames is approximately 20 – 30 m wide and relatively undisturbed with only occasional boat traffic. Habitat adjacent to the river consists mainly of arable fields, with scrub and hedgerows interspersed along field boundaries, and small areas of broad-leaved woodland. The river is likely to support a number of fish species which will provide a suitable foraging resource for Otter. Small areas of woodland and dense vegetation, along the banks of this section of the River Thames provide potential suitable foraging, breeding, resting and holt/couch creation habitat for Otter. The south bank of the River Thames has occasional fishing spots and the north riverbank has a public footpath which is likely to cause some disturbance to Otter.	2 nd April 2020	Yes
		10 th July 2020	Yes
		17 th August 2020	Yes
		9 th September 2020	Yes
WB03	This ditch is approximately 1 m wide, increasing to 2 m in some places. The ditch runs through a section of mature broad-leaved trees, providing good cover for Otter. The water quality appeared to be good but less than 10 cm in depth, which is likely to limit the present of fish. No other potential prey species for Otter were observed.	10 th July 2020	No
		16 th September 2020	No

Watercourse (see Figure 3a)	Habitat Description	Dates of Survey	Signs of Otter recorded? (Yes / No)
Moor Ditch (Section WB07)	This ditch has steep banks overshadowed by dense trees and scrub. Dense emergent vegetation and broad-leaved woodland provide excellent holt and couch habitat for Otter, although no fish or other potential prey species were observed within the ditch.	24 th June 2020	No
		18 th September 2020	Yes
Moor Ditch (Section WB08)	An open concrete ditch with a channel approximately 2 m wide and water 10cm deep.	18 th September 2020	Yes
Moor Ditch (Section WB09)	An open concrete ditch with a channel 2 m wide and water 10cm deep. Aquatic vegetation present on the margins of channel.	3 rd July 2020	Yes
		16 th September 2020	Yes
Moor Ditch (Section WB10)	Stream with steep banks with soft substrate and water level, ranging from less than 50cm to 1 m in depth. The channel width is up to 3 m wide.	3 rd July 2020	Yes
		18 th September 2020	No
Moor Ditch (Section WB12)	This ditch is fenced with dense vegetation and offers some commuting potential for Otter. Fish were observed to be present.	4 th June 2020	No
		9 th September 2020	No
Moor Ditch (Section WB13)	This ditch runs through arable land with hedges and scrub lining field boundaries. On the banks of the ditch, there are areas of dense scrub and scattered trees which can provide shelter and cover for Otter but unlikely to provide optimal holt/couch creation habitat. This ditch is likely to support smaller fish species which can be prey for Otter.	29 th April 2020	Yes
		5 th August 2020	Yes
WB14	This ditch runs through arable land with hedges and scrub lining field boundaries. The woodland next to the ditch provides excellent holt and couch habitat for Otter, although no fish or other potential prey species were observed within the ditch.	14 th May 2020	No
		16 th September 2020	Yes
WB15	The ditch is not ideal for Otters due the absence of holt and couch habitat. Furthermore, the water is shallow with limited potential to support large fish species.	14 th May 2020	No
		17 th August 2020	No

Water Vole

- 4.2.4 The results of the Water Vole field surveys carried out for the four watercourses are presented below in Table 4-3. In summary, no evidence of Water Vole was found in any of the watercourses surveyed (see Figure 3b). Site photographs are presented in Appendix B.

Table 4.3 Results of Water Vole field surveys undertaken within the survey area in 2020

Watercourse (see Figure 3b)	Habitat Description	Date of Survey	Signs of Water Vole recorded (Yes / No)
River Thames	The section of River Thames surveyed was approximately 20 – 30 m wide and relatively undisturbed with the occasional boat traffic. The River Thames has aquatic and emergent vegetation and a fast flow of water.	2 nd April 2020	No
		10 th July 2020	No
WB03	Ditch is approximately 1 m wide, increasing to 2 m in some places. The ditch has limited bankside vegetation, stony banks, shallow water and mature trees heavily shading the ditch.	6 th July 2020	No
		16 th September 2020	No
Moor Ditch (Section WB07)	Ditch has steep banks which are densely vegetated and heavily shaded. The bank height is variable, ranging from less than 1 m to more than 2-3 m, and is vertical in places. The ditch holds water less than 20cm deep which is generally slow flowing, with a channel width over 2-3 m.	24 th June 2020	No
		18 th September 2020	No
Moor Ditch (Section WB10)	Ditch is partially shaded steep banks with soft substrate and consistent water level, ranging from less than 50cm to 1 m in depth. The channel width is up to 3 m wide.	3 rd July 2020	No
		18 th September 2020	No
Moor Ditch (Section WB13)	Ditch runs through arable land with hedges and scrub lining field boundaries. The banks are steep with plenty of herbaceous vegetation but not heavily shaded in some areas. The water is more than 50cm deep and is slow flowing with plenty of herbaceous vegetation. The ditch has good connectivity with other water courses.	29 th April 2020	No
		5 th August 2020	No
WB15	Ditch has steep banks with aquatic vegetation and Soft Rush <i>Juncus effusus</i> on the margins and a slow flow of water. The ditch is also connected to a waterbody. However, this ditch dries annually and so is unlikely to support Water Vole.	14 th May 2020	No
		17 th August 2020	No

Camera Trap Survey

- 4.2.5 Two camera traps were deployed within locations that were identified as being in use by Otter in 2020.

Camera Trap 1

- 4.2.6 Camera Trap 1 was deployed on a potential holt site within Moor Ditch. No videos of Otter were returned by Camera Trap 1, however a single adult Fox (*Vulpes vulpes*) was recorded on three recordings entering and exiting the hole. Therefore, it is unlikely that the mammal hole is used by Otter. The other two potential resting places were not subject to camera monitoring and therefore, a precautionary approach should be considered.

Camera Trap 2

- 4.2.7 Camera Trap 2 was deployed on a section of mud bank of the River Thames, which had signs of Otter in 2020. A total of 18 recordings of Otter were returned by Camera Trap 2, with one video recording three Otters on a single occasion. One video of Mink was also recorded.

5. Evaluation

5.1 Summary

- 5.1.1 The Otter surveys undertaken in 2020 identified the presence of Otter in the River Thames and Moor Ditch. Both watercourses are crossed by the Scheme.
- 5.1.2 No evidence of Water Vole was found within the Site, or in adjacent riparian habitats, during surveys undertaken in 2020.

5.2 Otter

- 5.2.1 Evidence of Otter was recorded in three watercourses (River Thames, Moor Ditch (which includes survey sections WB07, WB08, WB09, WB10 and WB13), and WB14. No evidence of Otter was recorded in either of the other surveyed watercourses (WB02 and WB03) and therefore there are no constraints associated with any works within these areas.
- 5.2.2 A summary of the results of the Otter survey are included below and the locations of each watercourse are presented in Figure 3a.

River Thames

- 5.2.3 Significant Otter activity was recorded on this stretch of the River Thames during all survey seasons in 2020. Old, recent and fresh Otter spraints were recorded along the north bank of the section of River Thames surveyed, as well as five old Otter spraints recorded on the south bank. Furthermore, potential Otter resting sites were recorded along the north bank of the river, although these were not confirmed. The camera trapping survey recorded up to three Otter using a well-worn path (slide / haul out). Generally, the bankside habitat along the River Thames consists of scrub and woodland areas which provide good cover for Otter and the potential for Otter holts, although no holts were recorded along the stretch of the River Thames surveyed. However, it is highly likely that one or more Otter holts are present along the River Thames, outside of the surveyed area.
- 5.2.4 Therefore, Otter presents a constraint to the Scheme within this area.

Moor Ditch (Section WB07)

- 5.2.5 Many fresh and old Otter spraints and an Otter footprint were recorded along the watercourse. Old Otter spraints were also found under a bridge within the watercourse. Furthermore, the woodland next to the watercourse provides excellent Otter holt and couch habitat, although no holts were recorded during the surveys.
- 5.2.6 WB07 is approximately 500 m from the Site and so will not be directly impacted by the Scheme.

Moor Ditch (Section WB09)

- 5.2.7 Many fresh and old Otter spraints with Signal Crayfish (*Pacifastacus leniusculus*) remains, were noted on the eastern and western end of the watercourse, with a significant number recorded on a pipe within the watercourse. No Otter holts or good holt habitat was recorded on the banks of this watercourse, which suggests the watercourse is used as a commuting and foraging route. The camera trapping survey did not record any Otter using Moor Ditch between 12th May and 11th June 2021.

5.2.8 WB09 links between WB07 and WB10 and crosses the Site.

Moor Ditch (Section WB10)

5.2.9 Three potential Otter resting sites, two of which were within cavities of adjacent willow (a species of *Salix*). trees with lots of fresh spraints recorded within or close to the cavities, were found on the banks of WB10 (mapped as a single point on Figure 3a). The third potential Otter resting site was recorded under a willow tree and an Otter spraint was found on a ledge within the ditch. The presence of Signal Crayfish and their burrows also suggests good foraging habitat for Otter.

5.2.10 WB10 is linked to WB09 and is crossed by the Scheme.

Moor Ditch (Section WB13)

5.2.11 An Otter resting site was recorded close to a green plastic pipe which had lots of fresh and old Otter spraints found on top. Two potential Otter resting sites were also recorded within cavities of two willow trees, although no other evidence of Otter was found close to these trees. An Otter spraint and footprint were also recorded within the centre of the ditch. Furthermore, Signal Crayfish and their burrows were present, suggesting good foraging habitat for Otter.

5.2.12 WB13 is to the east of the Scheme, but there are potential links to WB09 and WB10 (both of which support Otter) through sub-optimal habitat of WB12.

Moor Ditch (Section WB14)

5.2.13 Two Otter spraints were recorded within this watercourse, one of which was found next to a mammal hole, which could occasionally be used by Otter. The woodland next to the ditch also provides excellent holt and couch habitat and the presence of Signal Crayfish suggests good foraging habitat for Otter.

5.2.14 WB14 is to the east of WB13 with no hydrological links.

5.3 Water Vole

5.3.1 No evidence of Water Vole was recorded within any of the watercourses within the survey area (see Figure 3b).

5.3.2 However, good Water Vole habitat was recorded within watercourses WB07 and WB 13. Furthermore, data search records of Water Vole were returned from within WB 13. Water Vole data search records were also returned from within the Sutton Courtenay Environmental Education Centre where WB07 is located.

6. Conclusions and Recommendations

6.1 Summary

- 6.1.1 Otter and Water Vole are both fully protected under Schedule 5 of the Wildlife & Countryside Act 1981 (as amended). Otter was recorded within the Site and wider survey area. No Water Vole was recorded on the Site, but there is potential presence for this species, based on habitat quality and results of the desk study.
- 6.1.2 Through the implementation of a mitigation strategy, formalised through a Construction and Environment Management Plan (CEMP), the potential for deliberate harm and injury to Otter and Water Vole will be avoided. Mitigation is required to:
- ensure compliance with relevant legislation; and
 - avoid impacts that will give rise to a potential “significant effect”, therefore contrary to planning policy and biodiversity obligations of the NERC Act 2006.
- 6.1.3 A significant negative effect is one which undermines nature conservation objectives or changes the conservation status of a species’ population.
- 6.1.4 Any impacts upon riparian mammals, arising as a result of construction or operation of the Scheme, are considered to have a potentially significant adverse impact. Potential impacts upon riparian mammals include those arising from direct effects (such as loss of habitat) and indirect effects (such as disturbance, pollution effecting watercourses).

6.2 Pre-construction Otter and Water Vole Surveys

- 6.2.1 It is recommended that a pre-construction survey for riparian mammals is undertaken in habitats likely to be impacted by the Scheme, to check on known locations used by Otter, for any change in activity by Otter and, or Water Vole and for newly created Otter couches/holts or Water Vole burrows prior to construction. **This should include camera monitoring of all identified resting places.**

6.3 Precautionary Methods for Working

- 6.3.1 During construction, it is recommended that best practice methods be adopted, including implementation of measures to minimise noise, lighting and vibration disturbance to riparian mammals, where these species have been recorded, or where impacts are likely to occur.
- 6.3.2 All staff, employees and contractors must be made aware of the potential presence of Otter on and near the Site. It is recommended that formal site inductions and toolbox talks include information regarding the presence of Otter and that operatives are made aware of and understand their obligations with regards to preventing disturbance to Otter by following instructions based on the precautions detailed below.
- 6.3.3 Minimum working distances should be agreed, prior to commencement of works. At this stage the following key recommendations have been made:

- no construction plant or personnel to access open-water habitats and these must be safeguarded at all times to avoid effects to identified Otter paths and routes between habitats during the construction phase.
- no works in any watercourse that could impede Otter movement should be carried out.
- no lighting near the watercourse that could disturb any migrating Otter along the watercourse after dusk should be used.
- appropriate storage facilities for equipment and machinery must be located away from watercourses during construction to prevent pollution and/or run off into riparian habitats.

2.1.1 To reduce the pollution risk, it is important that run-off from the Site does not contain grass clippings, soil or sediment. Relevant measures to include in the Construction Environmental Management Plan (CEMP) are:

- plant and wheel washing should be carried out in a designated area of hard standing at least 10 metres from any watercourse or surface water drain, rock outcrop (hard rock at surface) or karstic sinkhole;
- run-off is collected in an impermeable sump - recycle and reuse water where possible;
- settled solids are removed regularly and appropriately disposed of;
- biodegradable oils should be used for vehicles and plant where possible, they should still be prevented from entering the water environment, preventing water from entering excavations, by using cut-off ditches; and
- where run off water is contaminated with silt or other pollutants such as oil this water must not be pumped or allowed to flow (directly or indirectly) into the water environment without treatment.

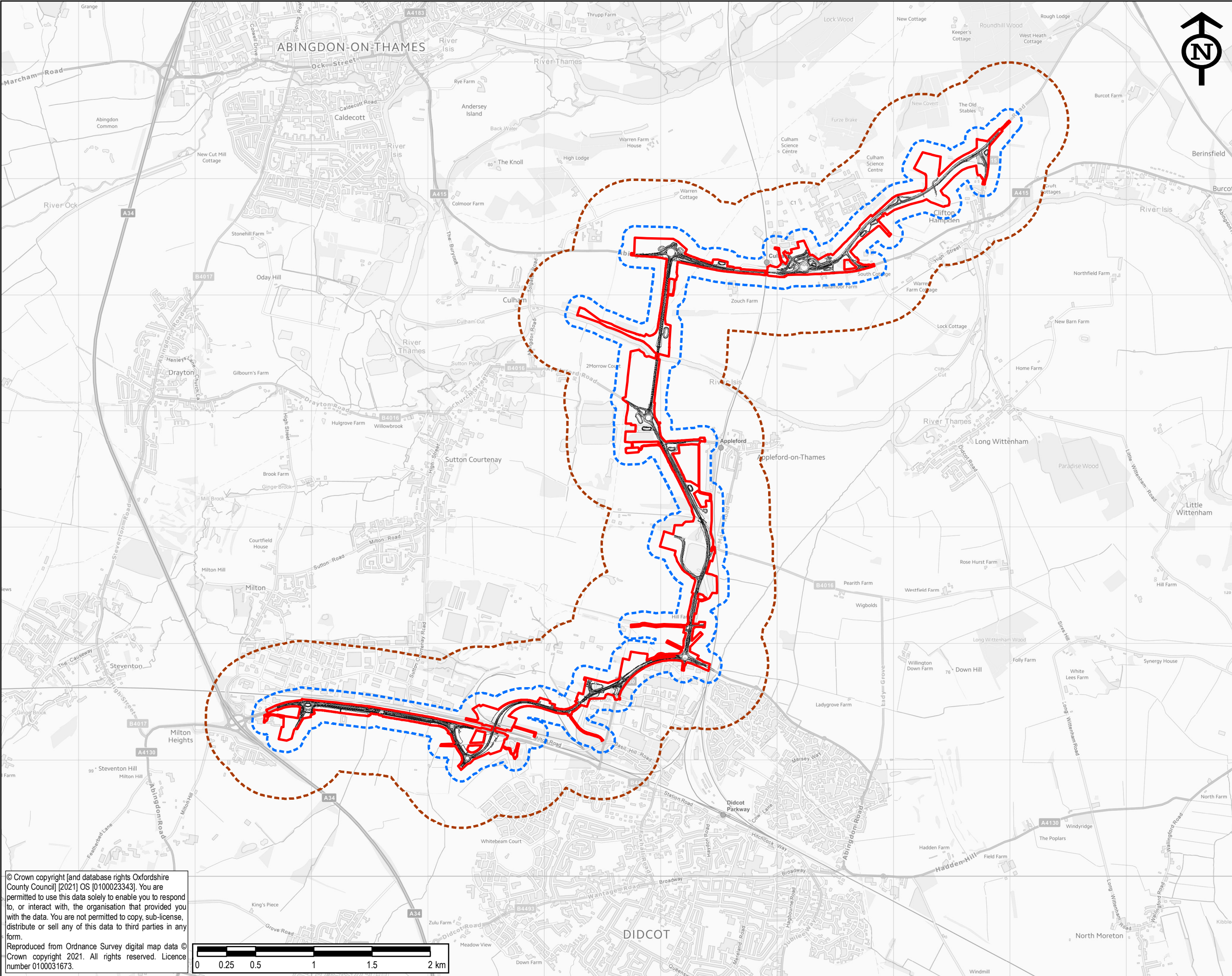
Appendix A Figures

Figure 1. Scheme Layout

Figure 2. Desk Study Records for Otter and Water Vole

Figure 3a. Otter Survey Results

Figure 3b. Water Vole Survey Results



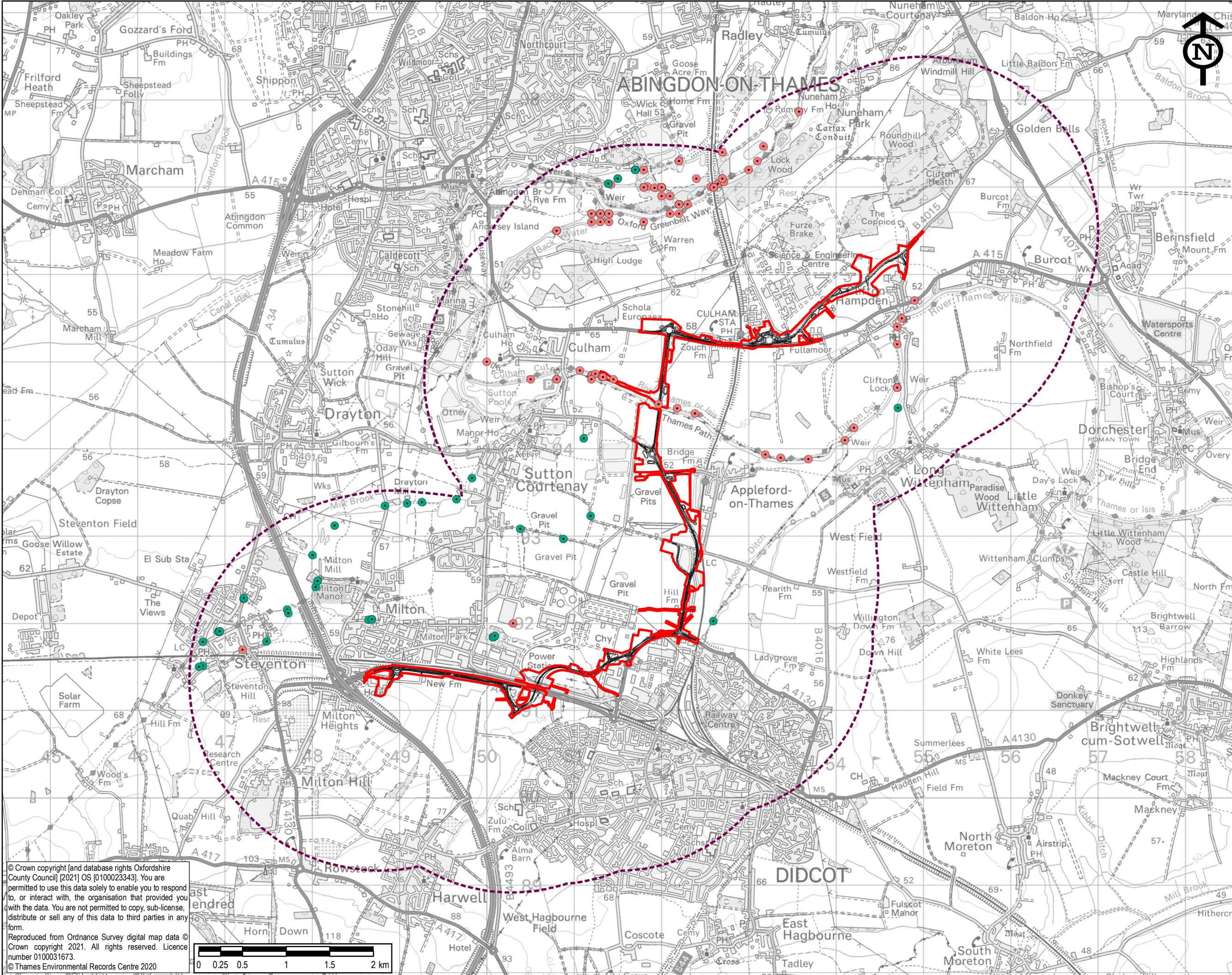
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LEGEND

- Indicative Red Line Boundary (Subject to Change)
- Indicative OCC Highway Design (Subject to Change)
- 100m Study Area
- 500m Study Area

First Issue	AG	21/07/2021	P01	
Revision Details	By	Date	Suffix	
Purpose of Issue				
FOR INFORMATION				
Client				
OXFORDSHIRE COUNTY COUNCIL				
Project Title				
DIDCOT GARDEN TOWN HIF 1 SCHEME				
Drawing Title				
FIGURE 1 SCHEME LOCATION				
Designed SG	Drawn AG	Checked LC	Approved AB	Date 23/08/2021
Internal Project No. 60632497		Suitability S2		
Scale @ A3 1:30,000		Discipline Ecology		
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LEGEND

Indicative Red Line Boundary (Subject to Change)

Indicative OCC Highway Design (Subject to Change)

TVERC Record:

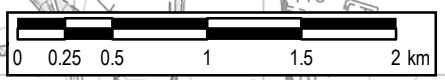
● European Otter

● European Water Vole

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FIGURE 2 DESK STUDY RECORDS FOR OTTER AND WATER VOLE				
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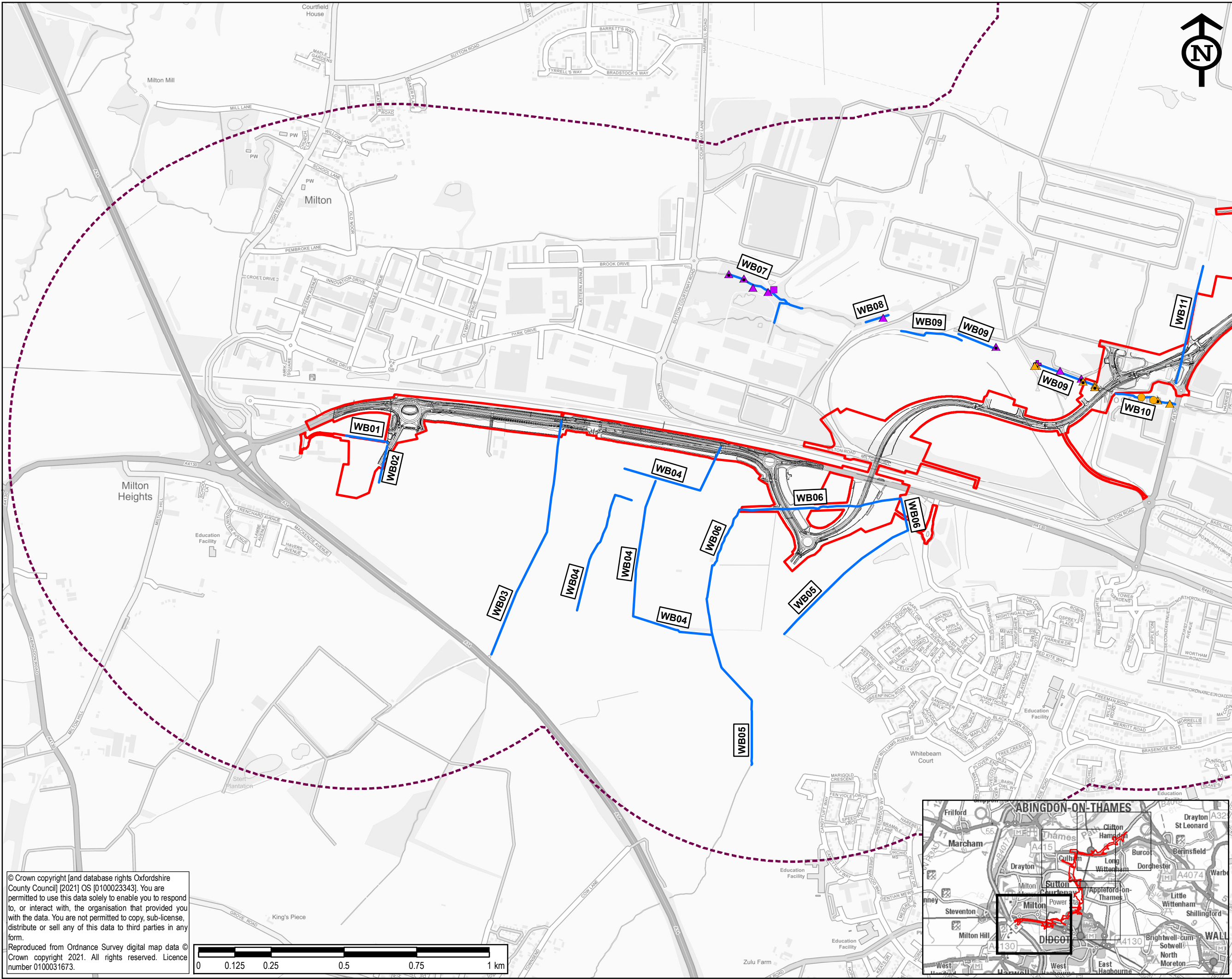
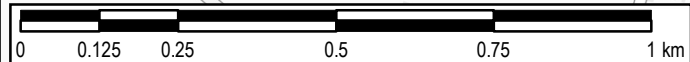
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- 1km Survey Buffer
- Watercourse Surveyed

AECOM Spring Survey:

- Otter Footprint
- Otter Sprint
- Otter Sprint (Multiple)
- Potential Otter Resting Site

AECOM Summer Survey:

- Otter Footprint
- Otter Slide
- Otter Sprint
- Otter Sprint (Multiple)
- Potential Otter Resting Site

AECOM Autumn Survey:

- Mammal Hole
- Otter Feeding Remains
- Otter Footprint
- Otter Sprint
- Otter Sprint (Multiple)

Other Sighting:

- Otter Carcass

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FIGURE 3A
OTTER SURVEY RESULTS
SHEET 1 OF 4

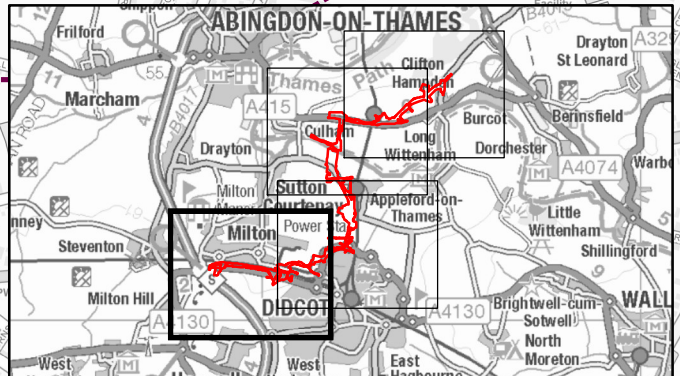
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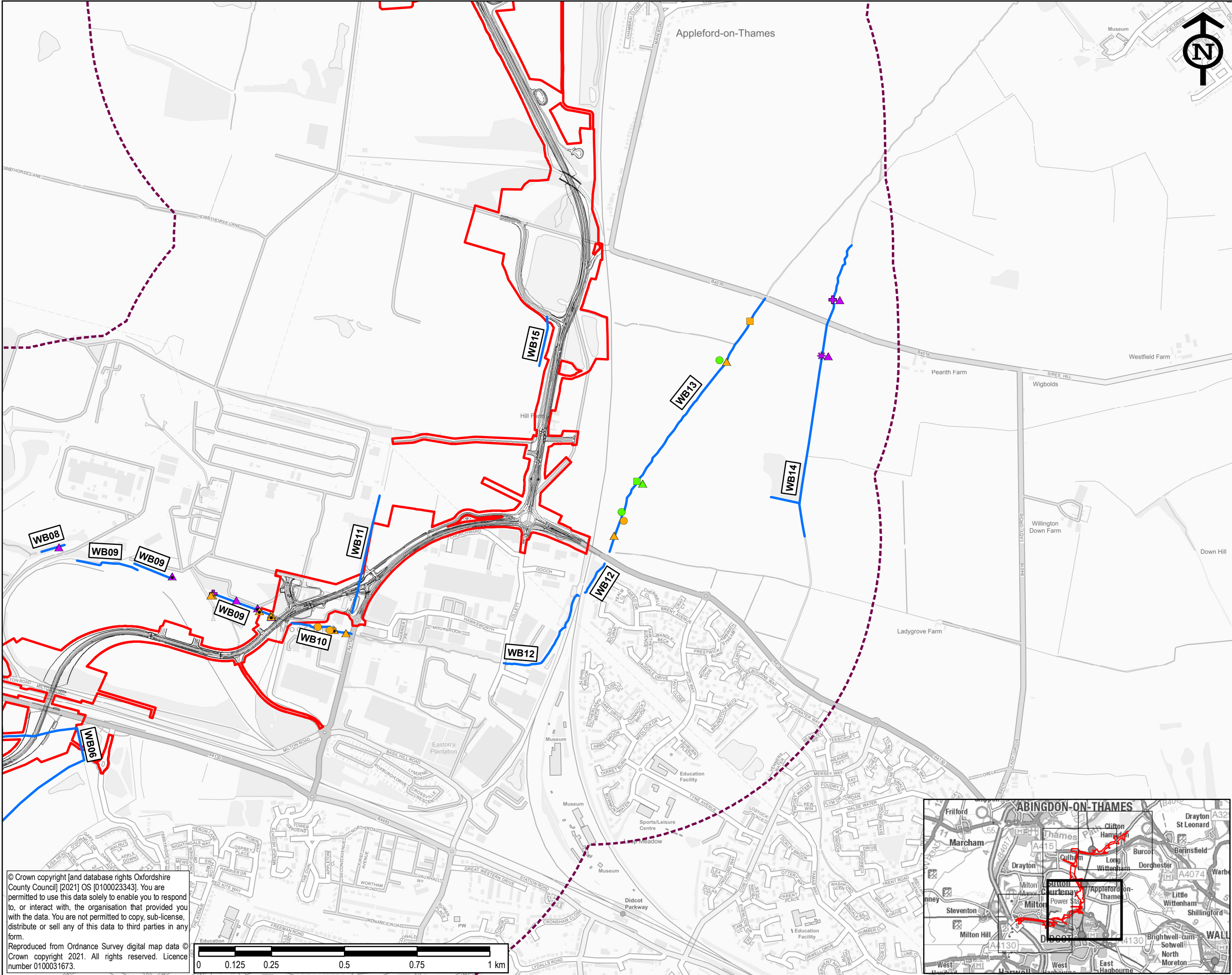
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- Otter Footprint
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- Otter Sprint (Multiple)

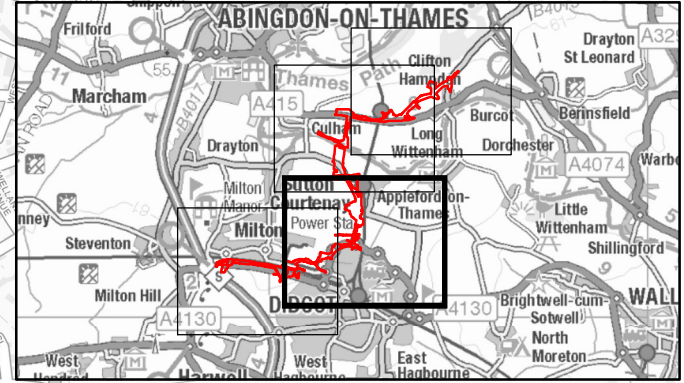
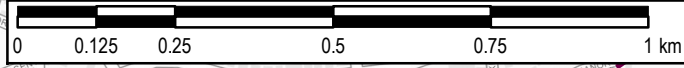
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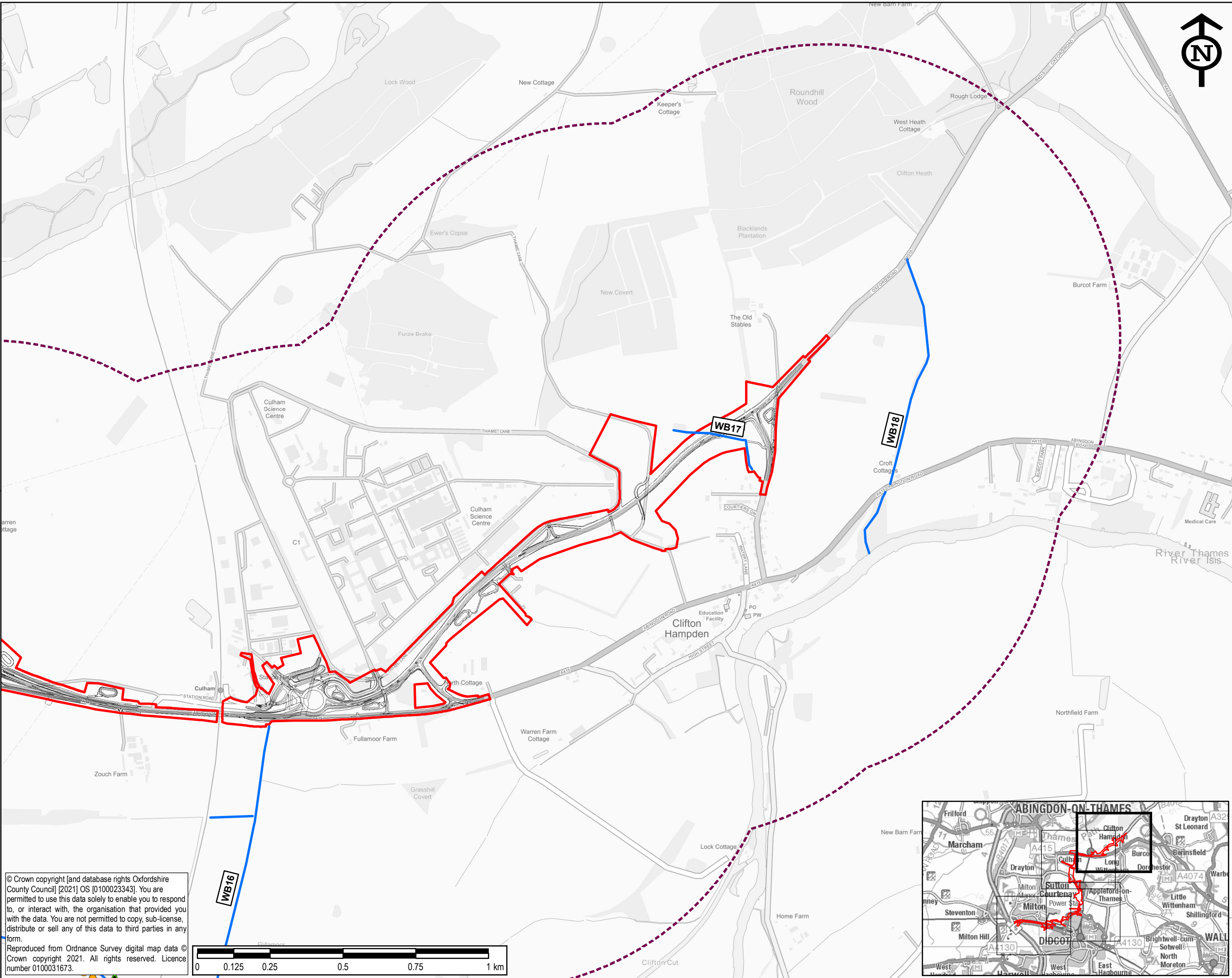
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Other Sighting:

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FIGURE 3A
OTTER SURVEY RESULTS
SHEET 4 OF 4

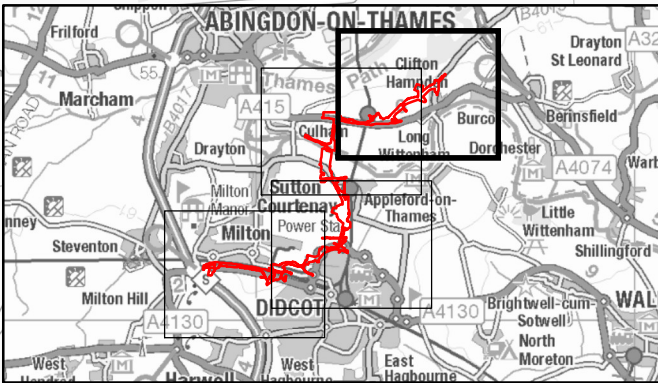
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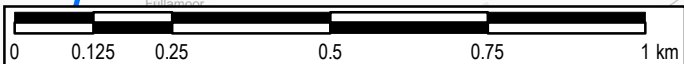
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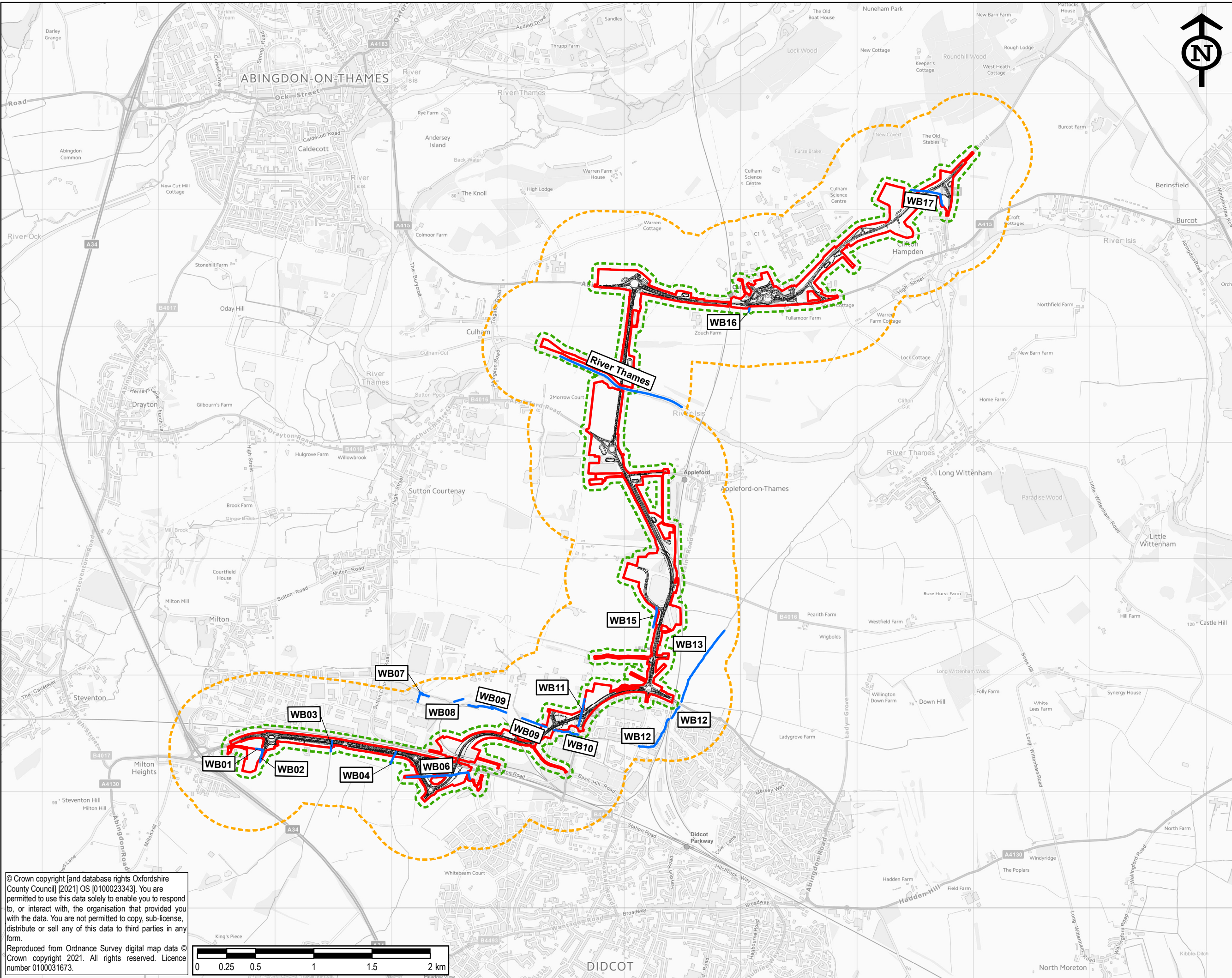
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- 500m Survey Buffer
- 50m Survey Buffer
- Watercourse Surveyed




No evidence of water vole found.

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Drawing Title	FIGURE 3B WATER VOLE SURVEY RESULTS			
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Appendix B Photos

Watercourse	Photo Number	Photo
River Thames	1	
WB03	2	
WB07	3	

Watercourse	Photo Number	Photo
WB08	4	
WB09	5	
WB10	6	

Watercourse	Photo Number	Photo
WB12	7	
WB13	8	
WB14	9	

Watercourse	Photo Number	Photo
WB15	10	

Annex 10 – Appendix 14.2: Water Framework Directive Report



REVISED

Didcot Garden Town HIF 1 Scheme

Environmental Statement

Volume III

Appendix 14.2: Water Framework Directive (WFD)
Assessment

October 2022

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1. Introduction

1.1 Background

- 1.1.1 This Water Framework Directive (WFD) Assessment has been prepared by AECOM in support of a planning application and accompanying Environmental Statement (ES) for the Didcot Garden Town Housing Infrastructure Fund (HIF 1) Scheme (hereafter referred to as the ‘Scheme’).

Oxfordshire County Council (OCC) proposed package of strategic transport improvements are vital elements of Didcot’s development as a “Garden Town”. The transportation package includes:

- A4130 Widening – The proposed improvement to the A4130 includes dualling widening between Milton Gate eastwards to the proposed Didcot Science Bridge. The proposal also includes the provision of new and improved pedestrian and cycling facilities.
- Didcot Science Bridge – A new road bridge link from the proposed A4130 Widening scheme, over the A4130, Great Western Railway and Milton Road connecting back to the A4130 north of Purchas Road roundabout, including pedestrian and cycling infrastructure.
- Didcot to Culham River Crossing – a new road between Culham near the Science Centre to Didcot’s A4130 perimeter road, including pedestrian and cycling infrastructure.
- Clifton Hampden Bypass – a new road between the A415, Abingdon Road, at the Culham Science Centre and B4015, Oxford Road, north of Clifton Hampden village.

- 1.1.2 A full description of the Scheme can be found in ES Chapter 2: The Scheme.

1.2 The Water Framework Directive

- 1.2.1 The legislative context for the Water Framework Directive (WFD) is summarised in Section 2: Overview of the Water Framework Directive. The overarching aim of the WFD is to protect and enhance the water environment. Consequently, this WFD assessment is presented as an appendix to ES Chapter 14: Road Drainage and the Water Environment, although it is also of relevance to ES Chapter 9: Biodiversity, and elements of other ES chapters.

- 1.2.2 Sufficient Scheme information, baseline and assessment are presented herein for the WFD to be understood as a standalone report. However, for concise reporting, some details drawn from the respective ES chapters are not repeated. For example, the WFD encompasses water quality, and the outcomes relevant to WFD as presented in ES Chapter 14: Road Drainage and the Water Environment are summarised here without detailed descriptions of analytical methods. Similarly, only key WFD compliance information is repeated from ES Chapter 9: Biodiversity and supporting aquatic ecology report (ES Appendices 9.5).

1.3 The Scheme

- 1.3.1 The 'Scheme' consists of four highway schemes, namely: i) the A4130 Widening; ii) Didcot Science Bridge; iii) Didcot to Culham River Crossing; and iv) Clifton Hampden Bypass.

- 1.3.2 An overview of the Scheme and affected water bodies is presented in Annex A.

A4130 Widening

- 1.3.3 This part of the Scheme comprises a dual carriageway from a point approximately 250 m east of Milton Interchange at the junction with Milton Gate, eastwards for approximately 1.6 km to the proposed eastern roundabouts connecting into the future development at Valley Park and the Science Bridge scheme.
- 1.3.4 Several new drainage structures are required where the A4130 crosses Meadow Brook, Stert Brook, Cow Brook, and a ditch adjacent to Backhill Lane.
- 1.3.5 There will also be new balancing ponds that control highway runoff quantity and quality from new highways surfaces before discharging to drainage ditches and watercourses.

Didcot Science Bridge

- 1.3.6 This section of the Scheme is a new north-south bridge from the proposed Science Bridge roundabout, over the Great Western Mainline Railway, the existing A4130 and Milton Road, into the former Didcot A Power Station site. The proposed Science Bridge Link Road will connect the bridge with the A4130 Northern Perimeter Road north of the Purchas Road/ Hawksworth roundabout, close to the existing Southmead Industrial Estate.
- 1.3.7 There will be new balancing ponds that control runoff highway quantity and quality from new highways surfaces before discharging to drainage ditches and watercourses.
- 1.3.8 An existing culvert on Moor Ditch will be replaced with a new, shorter culvert as part of the Scheme.

Didcot to Culham River Crossing

- 1.3.9 This part of the Scheme includes a new link road between the A4130 at the existing Collett roundabout junction (Didcot) and the A415 at Culham. It includes two new bridges: one over the River Thames and one over the Hanson private railway sidings near Appleford level crossing.
- 1.3.10 The bridge over the River Thames is central to a new viaduct across the Thames floodplain including an area of ongoing gravel pit restoration to aquatic habitat known as the Hanson Finger Lakes. There will be a small length of culvert at the tie-in of viaduct to ground-level highway.
- 1.3.11 There will be new balancing ponds that control highway runoff quantity and quality from new highways surfaces before discharging to drainage ditches and watercourses.

Clifton Hampden Bypass

- 1.3.12 This part of the Scheme will provide a new single carriageway link between the A415 at Culham Science Centre and the B4015 Oxford Road, to the north of Clifton Hampden.
- 1.3.13 This section of the Scheme does not cross any perennial watercourses but does include several new drainage structures for existing drainage ditches that are typically dry and are not aquatic habitats.
- 1.3.14 There will be new balancing ponds that control highway runoff quantity and quality from new highways surfaces before discharging to drainage ditches.

2. Overview of the Water Framework Directive

- 2.1.1 The Water Environment (Water Framework Directive) (England and Wales) Regulations 2017, commonly referred to as the Water Framework Directive or the WFD, aims to protect and enhance the water environment.
- 2.1.2 The WFD takes a holistic approach to sustainable management of the water environment by considering interactions between surface water, groundwater and water-dependent ecosystems. Ecosystem conditions are evaluated according to interactions between classes of biological, chemical, physico-chemical and hydromorphological elements known as 'Quality Elements'.
- 2.1.3 Under the WFD, 'water bodies' are the basic management units, defined as all or part of a river system or aquifer. Waterbodies form part of a larger 'river basin district' (RBD), for which 'River Basin Management Plans' (RBMPs) are used to summarise baseline conditions and set broad improvement objectives. RBMPs are produced every six years, in accordance with the river basin management planning cycle. The current RBMPs at the date of this assessment are the 2015 Cycle 2 plans. The Cycle 2 plans are due to be updated to Cycle 3 plans, but the latter are not yet available.
- 2.1.4 In England, the Environment Agency (EA) is the competent authority for implementing the WFD, although many objectives are delivered in partnership with other relevant public bodies and private organisations, for example local planning authorities, water companies, rivers trusts, and private landowners and developers.
- 2.1.5 The EA is also responsible for managing flood risk and other activities on Main Rivers. Local planning authorities or drainage boards are responsible for consenting certain activities on Ordinary Watercourses. Local planning authorities are responsible for highways drains, and landowners are responsible for ditches and watercourses and piped watercourses and culverts. While the EA is ultimately responsible for the WFD on any water body, local authorities are required to plan and consent WFD related activities on Ordinary Watercourses.
- 2.1.6 As part of its regulatory and statutory consultee role on planning applications and environmental permitting (under the Environmental Permitting Regulations (England and Wales) 2016), the EA and WFD-partnering organisations, must consider whether proposals for new developments have the potential to:
- Cause a deterioration of any quality element of a water body from its current status or potential; and/ or
 - Prevent future attainment of good status or potential where not already achieved.
- 2.1.7 In determining whether a development is compliant or non-compliant with the WFD objectives for a water body, the EA and partnering organisations must also consider the conservation objectives of any Protected Areas (i.e. Natura 2000 sites or water dependent Sites of Special Scientific Interest) and adjacent WFD water bodies, where relevant.
- 2.1.8 Regulation 17 of the Water Environment Regulations 2017 (i.e. the WFD) states that, like other public bodies, local authorities have a statutory duty to "*have regard to the River Basin Management Plan*" and "*any supplementary plans*" covering proposed activities when exercising its functions.

2.1.9 Local authorities must therefore reflect water body improvement priorities as outlined in RBMPs. Key local authority functions which can contribute to WFD objectives include:

- Local planning policies;
- Development management and building control functions;
- Green infrastructure plans;
- Highways design;
- Drainage, flood risk management and sustainable drainage system (SuDS) functions; and
- Planning applications.

2.1.10 The EA and OCC must therefore consider whether proposals for the Scheme have potential to:

- Cause deterioration in the ecological status/ potential classification of any water body (e.g. from Moderate to Poor);
- Prevent any waterbody from meeting its future objective of Good ecological status/ potential;
- Cause failure to meet Good groundwater status or result in a deterioration of groundwater status; and
- Prevent the implementation of mitigation measures which define the hydromorphological designation of heavily modified waterbodies.

3. Assessment Methodology

3.1 Approach to WFD

- 3.1.1 There are no fixed methods for WFD assessment. The nature of the water environment and the breadth of the legislation mean that assessments are tailored to proposals on a case by case basis.
- 3.1.2 The following general guidance is available which has been applied for this assessment:
- EA (2016a). Water Framework Directive risk assessment. How to assess the risk of your activity (Ref 1).
 - EA (2016b). Protecting and improving the water environment. Water Framework Directive compliance of physical works in rivers (Ref 2).
 - The Planning Inspectorate (2017). Advice Note eighteen: The Water Framework Directive (Ref 3).
- 3.1.3 A stepwise approach consisting of Screening, Scoping and Impact assessment stages is generally followed in order to: (a) rationalise the levels of WFD assessment and impact mitigation that are required; and (b) verify that proposals meet the requirements of the WFD. The general approach is described in The Planning Inspectorate (2017). Advice Note eighteen: The Water Framework Directive (Ref 3) and is briefly summarised below.
- 3.1.4 This WFD assessment comprises Stage 1 Screening and Stage 2 Scoping. Some further Stage 3 Impact Assessment will be required in the future, but this will only be possible when detailed designs become available.

Stage 1: Screening

- 3.1.5 Screening identifies the zone of influence of a proposed development, and if proposed activities pose a risk to the water environment. It is used to identify if there are activities that do not require further consideration for WFD objectives, for example activities which have been ongoing since before the current RBMP plan cycle and which have thus formed part of the baseline.
- 3.1.6 In this case, the Scheme involves upgrades to existing infrastructure as well as the construction of new infrastructure, so historic watercourse realignments and drainage systems can be screened out of the assessment.

Stage 2: Scoping

- 3.1.7 Scoping is used to identify any potential impacts of the proposed activities to specific WFD receptors and their water quality elements. This involves review of WFD impact pathways, shortlisting which WFD water bodies and quality elements could or could not be affected by proposed activities, and collecting baseline information from the relevant RBMP on the status and objectives for each water body.
- 3.1.8 The Scheme has potential to interact with a number of existing highway and drainage land drainage systems, but many of these are dry until activated by rainfall runoff. As such, each watercourse crossing was reviewed at baseline for whether it could support aquatic habitats. Dry ditches were screened out of further assessment as unable to support WFD biological objectives, but were still considered in terms of potential pollution pathways to connecting water bodies.

Stage 3: Impact Assessment

- 3.1.9 This involves rationalised assessment of water bodies and quality elements that could be affected by proposed activities, to identify any areas of WFD non-compliance. Proposed activities are reviewed in terms of both positive and negative impacts, and the baseline mitigation measures, enhancements, and contributions to the WFD objectives described in the RBMP. Any proposed activities with potentially deleterious impacts are reviewed simultaneously with their corresponding mitigation proposals, to determine a net effect on WFD objectives.

Mitigation Commitment

- 3.1.10 Proposed mitigation activities relied upon to demonstrate compliance at any of the stages referred to above must be appropriately defined and sufficiently secured. Mitigation could be secured through planning licence conditions, Development Consent Orders (DCOs), or other legally binding methods.

Derogation under Regulation 19 of The Water Environment (Water Framework Directive) (England and Wales) Regulations 2017

- 3.1.11 Where the potential for deterioration of water bodies is identified, and it is not possible to mitigate the impacts to a level where deterioration can be avoided, additional assessment is needed in the context of the Water Environment (Water Framework Directive) (England and Wales) Regulations 2017 Regulation 19, which covers procedures for derogation.
- 3.1.12 A failure to prevent deterioration from high status to good status of a body of surface water is not a breach of the environmental objectives set for it under Regulation 19 if:
- The failure is the result of new sustainable development activities, and
 - All practicable steps are taken to mitigate the adverse impact on the status of the waterbody; and
 - The reasons for the modifications or alterations, or for the sustainable development activities, are of overriding public interest; or the benefits to the environment and to society of achieving the environmental objectives are outweighed by the benefits of the new modifications or alterations, or of the sustainable development activities, to human health, to the maintenance of human safety, or (in the case of modifications or alterations) to sustainable development; and
 - The beneficial objectives served by the modifications or alterations, or by the sustainable development activities, cannot, for reasons of technical feasibility or disproportionate cost, be achieved by other means which are a significantly better option.

3.2 WFD Data

- 3.2.1 Relevant data have been collected from the EA's Catchment Data Explorer¹ and various other online resources, as well as site inspection reports and design reports. Site specific data have also been collected from:
- | | |
|------------------|------------------------|
| • Scheme designs | • Ordnance Survey maps |
| • Site visits | • Aerial photography |
| • ES chapters | • Historic maps |

¹ <https://environment.data.gov.uk/catchment-planning/>. Accessed August 2022

- Geology and soil data
- Defra MAGIC maps

3.3 Low Risk Activities

- 3.3.1 Certain activities on or near waterbodies are considered low risk by the Environment Agency (2016b) (Ref 2), as summarised in Table 3.1. If the Scheme or components of the Scheme meet the criteria in Table 3.1, they may be screened out of any further assessment.

Table 3-1: WFD Low Risk Activities

Activity	Type of Modification
Low impact maintenance activities (encourage removal of obstructions to fish/ eel passage)	Re-pointing (block work structures)
	Void filling ('solid' structures)
	Re-positioning (rock or rubble or block work structures)
	Replacing elements (not whole structure)
	Re-facing
	Skimming/ covering/ grit blasting
	Cleaning and/or painting of a structure
Temporary works	Temporary scaffolding to enable bridge re-pointing
	Temporary clear span bridge with abutments set-back from bank top
	Temporary coffer dam (if eel/ fish passage not impeded)
	Temporary flow diversion (if fish/ eel passage not impeded) such as flumes and porta-dams
	Repair works to bridge or culvert which do not extend the structure, reduce the cross-section of the river or affect the banks or bed of the river, or reduce conveyance
	Excavation of trial pits of boreholes in byelaw margin
	Structural investigation works of a bridge/ culvert/ flood defence such as intrusive tests, non-intrusive surveys
Bridges	Permanent clear span bridge, with abutments set-back from bank top
	Bridge deck/ parapet replacement/ repair works
	Replacing road surface on a bridge
Service crossing	Service crossing below the riverbed, installed by directional drilling or micro tunnelling if more than 1.5 m below the natural bed line of the river
	Service crossing over a river. This includes those attached to the parapets of a bridge or encapsulated within the bridge's footpath or road
	Replacement, installation or dismantling of service crossing/ high voltage cable over a river
Other structures	Fishing platforms
	Fish/ eel pass on existing structure (where <2% water body length is impacted)
	Cattle drinks
	Mink rafts
	Fencing (if open panel/ chicken wire) in byelaw margin

4. Baseline Assessment

4.1 Overview

- 4.1.1 WFD data for the water bodies screened in for assessment have been gathered from the EA's Catchment Data Explorer. Additional baseline data have been assessed for local water environment biology, hydromorphology and chemistry/ physico-chemistry. Further baseline detail is also provided in ES Chapter 14: Road Drainage and the Water Environment.

4.2 Study Area

General Site Characteristics

- 4.2.1 Land use along the route of the Scheme is generally agricultural, and comprises a mixture of arable, sheep and equine pasture. The area is crossed by existing roads including the A4130 and A415, as well as minor roads or lanes.
- 4.2.2 There are several significant business and industrial parks in the area. To the north of the A4130, The Milton Park development is a prominent feature of the area, including business and industrial units. To the north of Clifton Hampden is the Culham Science Centre (CSC), again featuring business units and research facilities.
- 4.2.3 The former Didcot A Power Station site will be crossed by the Scheme. The Great Western Railway Line crosses the Scheme in a west to east orientation, adjacent to the A4130. The Cherwell Valley line, which connects Didcot Parkway station to Oxford on a north-south orientation, lies adjacent to the Scheme alignment.
- 4.2.4 A significant portion of the Didcot to Culham River Crossing route is used for quarrying of materials for, or the production of, cement products. The resulting restoration has created ponds associated with quarrying in the region around Appleford, but these are generally avoided by the Scheme.
- 4.2.5 The Didcot to Culham River Crossing section of the Scheme crosses areas of infilled land west and south-west of Appleford that are related to the presence of historic landfill sites. The Site also crosses the Sutton Courtenay Landfill licenced waste management facility between Appleford Sidings.
- 4.2.6 The topography of the study area varies between 60 metres Above Ordnance Datum (mAOD) towards the south, around the A4130 Widening, falling towards the River Thames to 49 mAOD and then increasing again to 53 mAOD to the north of the Scheme (although there are isolated areas with heights up to 58 mAOD). Overall, the study area is generally low-lying and flat.
- 4.2.7 The Proposed Scheme red line boundary and local watercourses are shown in Figure 4.1.
- 4.2.8 Reference numbers in Figure 4.1 are aquatic ecology survey locations, which were used as the basis of WFD screening, as described below for each WFD water body.

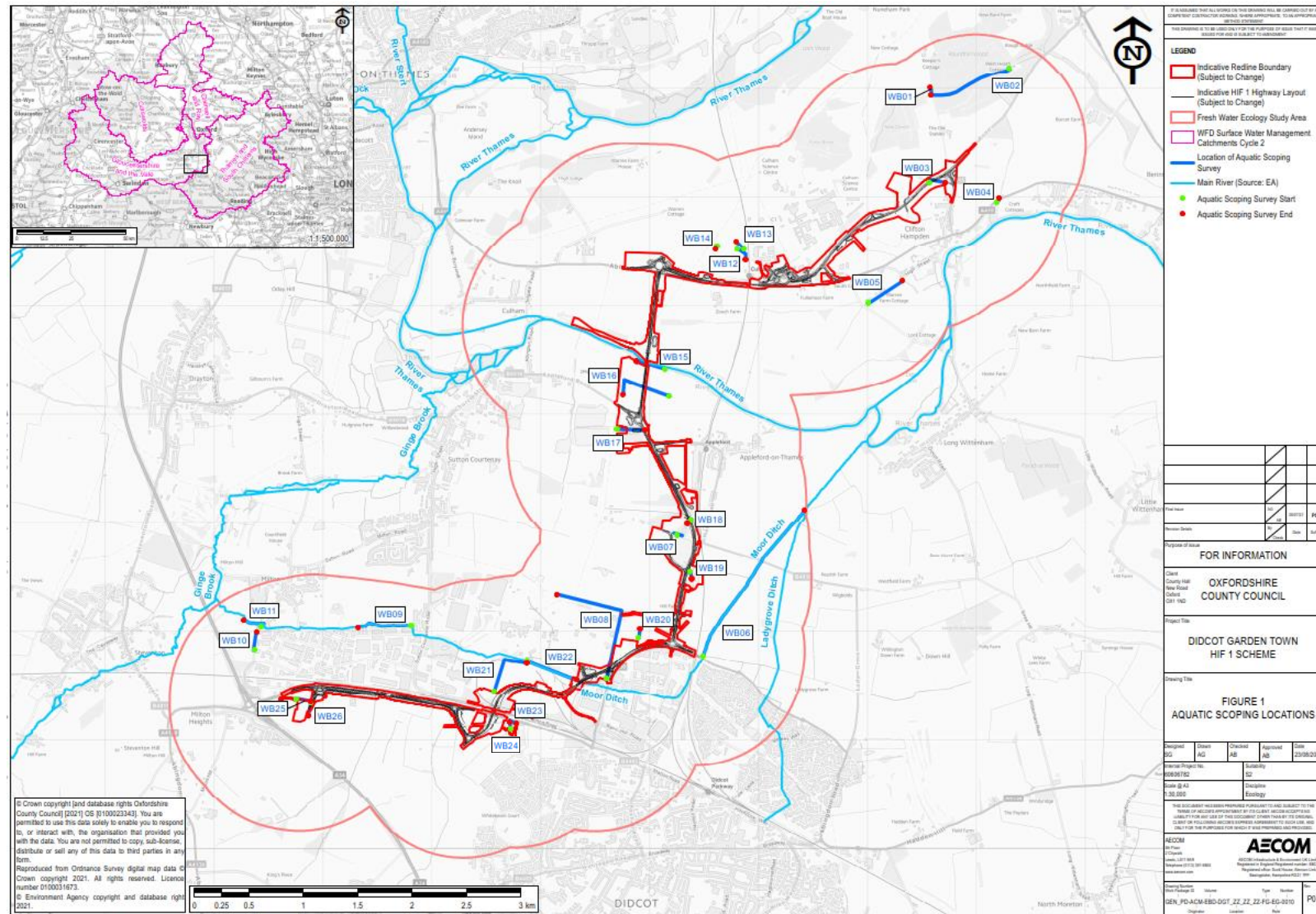


Figure 4.1 Proposed Scheme red line boundary and local watercourses

4.2.9 WFD baseline summaries and assessments presented below are based on hydromorphological walkovers and aquatic ecology surveys. Details of the rationalisation of survey and sampling locations are presented in:

- Environmental Statement Volume III Appendix 4.1: EIA Scoping Report and Scoping Opinion
- Environmental Statement Volume III Appendix 9.1: Preliminary Ecological Appraisal Report
- Environmental Statement Volume III Appendix 9.4: Aquatic Ecology Survey Report

4.2.10 Water quality assessments are also summarised below, the details of which are described in full in:

- Environmental Statement Volume I Chapter 14: Road Drainage and Water Environment
- Environmental Statement Volume III Appendix 14.3: Assessment of Routine Road Runoff and Accidental Spillages

4.3 Moor Ditch and Ladygrove Ditch WFD Water Body (Moor Ditch, Stert Brook and Meadow Brook)

WFD Classification and Proposed Mitigation Measures

4.3.1 Moor Ditch in the study area (see Annex A) is classified as the Moor Ditch and Ladygrove Ditch (GB106039023630) water body. WFD data are summarised in Table 4.1 from the EA's Catchment Data Explorer².

Table 4-1: Summary of WFD quality elements for the Moor Ditch and Ladygrove Ditch water body

WFD Parameter	Status/ Summary
Water Body ID	GB106039023630
Water Body Name	Moor Ditch and Ladygrove Ditch
Water Body Type	River
Water Body Length / Area	8.398 km / 26.87 km ²
Hydromorphological Designation	Not designated artificial or heavily modified.
Overall Ecological Status	Poor in 2015 (RBMP cycle 2); Poor in 2019 (most recent data)
Current Overall Status	Poor in 2015 (RBMP cycle 2); Poor in 2019 (most recent data)
Status Objective (overall)	Moderate in 2027 (Disproportionate burdens; no known technical solution is available)
Biological Quality Elements	Poor for Invertebrates and Macrophytes and Phytobenthos in 2015. Macrophytes improving to Moderate in 2019. Invertebrates subject to land drainage pressures associated with agriculture, urban developments and transport and sewage discharges.
Physico-chemical Quality Elements	Moderate in 2015 and 2019 due to Phosphates associated with point source pollution from trade and sewage treatment. Other measured elements are Good to High quality conditions.
Hydromorphological Quality Elements	Support Good potential
Chemical	Good in 2015 and Fail in 2019, although this is due to monitoring of priority hazardous substances introduced in 2019 and does not necessarily indicate deterioration. Failing substances are Polybrominated diphenyl ethers (PBDE), Perfluorooctane sulphonate (PFOS) and Mercury.
RBMP Priority Issues for the Ock Operational Catchment	Improve the status of invertebrates and engaging landowners to adjust land management practices to reduce diffuse pollution.

² <https://environment.data.gov.uk/catchment-planning/WaterBody/GB106039030334>. Accessed May 2021.

4.3.2 The water body has alternative local names, and several tributaries, which are labelled in the maps comprising Annex A, and summarised as follows:

- Moor Ditch is the main river of the waterbody. In the RBMP, Moor Ditch and Ladygrove Ditch are not differentiated, and combined they originate near Quab Hill before discharging to the River Thames at Long Wittenham. On OS maps, the watercourse is only named Moor Ditch after emerging from a culvert beneath the A4130 and Milton Park Estate in the vicinity of the power station.
- Ladygrove Ditch is a tributary to Moor Ditch, and will not be impacted by the Proposed Scheme, so is not discussed further.
- Stert Brook is the same watercourse as Moor Ditch, but on OS maps the watercourse is named as Stert Brook south of Milton Park Estate and the A4130.
- Cow Brook is a tributary to Moor Ditch, originating near Harwell and flowing north including through culverts beneath the A4130 and Milton Road, before confluenting with Moor Ditch near the power station cooling towers.
- An unnamed ditch at structure A4130_1 appears to be an artificial drain with direct and permanent aquatic connectivity to Moor Ditch, also south of the Milton Park Estate.
- Meadow Brook is a tributary to Moor Ditch, located south of the power station before being culverted beneath the A4130 and recently deculverted and realigned through the redeveloped power station.

4.3.3 The discussion below focusses on Moor Ditch as the primary channel of the waterbody. Local watercourse names are also used in places used to help clarify which parts of Moor Ditch are being assessed. Refer to maps in Annex A.

4.3.4 Specific locations along the route of Proposed Scheme are labelled from WB01 to WB26 in Figure 4.1. These are locations on Moor Ditch, or locations of minor, unnamed drains and ponds.

4.3.5 Each of the labelled features are discussed in turn under headings of WB01, etc, in the section below on Moor Ditch and Adjacent Water Features Aquatic Ecology. First, a general overview of the physical character of the Moor Ditch is summarised in Moor Ditch Hydromorphology.

Moor Ditch Hydromorphology

4.3.6 Moor Ditch is a typical lowland arable watercourse, not designated artificial or heavily modified, but highly modified within the urban study area (Figure 4.2). Locally it is straightened and trapezoidal, over-wide and over-deep due to historic flood management for an urbanised floodplain and has low base flow. There are areas of gravel habitat suitable for fish within Moor Ditch, but within the study area, gravel is sparse due to the channel realignment, numerous culverts and other impoundments, which impact morphological and biotic passage continuity. Water treatment is evident in the form of oil interceptors and trash screens, which reflects locally poor chemical as well as physical habitat quality.



Figure 4.2: Representative photographs of Moor Ditch at the existing culvert

- 4.3.7 Stert Brook i.e. Moor Ditch south of the A4130, is an arable watercourse, but highly modified and straightened with low base flow and low diversity of aquatic macroinvertebrates and macrophytes, and heavily shaded (Figure 4.3).



Figure 4.3: Representative photographs of Stert Brook south of the A4130

- 4.3.8 Meadow Brook is a typical lowland watercourse lined with hedgerows (Figure 4.4). Turbidity was high at the time of observation and baseflow was low. Throughout the Site, the brook is highly modified being uniform, straightened and trapezoidal, over-wide and over-deep. The bed was not visible, but is likely to naturally have gravels, although these will be overlain with excess silt deposits.



Figure 4.4: Representative photographs of Meadow Ditch south of the A4130

Moor Ditch and Adjacent Water Features Aquatic Ecology

Overview

- 4.3.1 The current WFD status of the Moor Ditch and Ladygrove Ditch water body is Poor overall, with Ecological status Poor and Chemical status Fail.
- 4.3.2 Aquatic habitat networks in the various watercourses comprising the water body are connected, but species movement is restricted between Stert Brook, Moor Ditch and Meadow Brook due to existing culverts. Baseline aquatic ecology surveys (Appendix 9.5 of the ES) found little biodiversity in Stert Brook and Meadow Ditch, but Moor Ditch, the main river of the waterbody, is more species rich.

Stert Brook

- 4.3.3 Baseline aquatic ecology surveys for the ES (refer to ES Chapter 9: Biodiversity) identified only one scoring species (*Apium nodiflorum*). Invertebrates scored as moderate by Community Conservation Index (CCI), while Percentage of Sediment-sensitive Invertebrates (PSI) score indicated heavy sedimentation in spring, and Lotic-invertebrate Index for Flow Evaluation (LIFE) shows high sensitivity to flow in autumn.

Meadow Brook

- 4.3.4 Baseline aquatic ecology surveys for the ES identified habitat of limited value (refer to ES Chapter 9: Biodiversity).

Moor Ditch

- 4.3.5 Baseline aquatic ecology surveys for the ES identified habitat of limited value (refer to ES Chapter 9: Biodiversity).
- 4.3.6 Aquatic macroinvertebrate indices calculated across the ditch indicate a variety of biological water quality conditions from poor to very good.
- 4.3.7 Physical habitat in Moor Ditch is low energy, in a straight channel on a low gradient, and with little diversity. The channel has been realigned, over-deepened and culverted in numerous places and, as a result, suffers from areas of fine silt deposition. The entire surveyed stretch consisted of run habitat with no dynamic fluvial processes.
- 4.3.8 The riparian area throughout the Site was predominantly vegetated with broadleaved trees, scrub and tall ruderal vegetation. Himalayan balsam *Impatiens glandulifera* was recorded at numerous locations along the ditch. Otter spraint was present at several locations and was composed primarily of signal crayfish *Pacifastacus leniusculus* remains, evidence the site supports protected mammal species.
- 4.3.9 The macrophyte assemblage varied between bad and high WFD status and there was a low diversity of taxa, likely caused by the variation in shading conditions across the ditch.
- 4.3.10 Bullhead *Cottus gobio* records exist in Moor Ditch and their eDNA has been identified. Bullhead is an Annex II species under the Habitats Directive which means they are a species of Community interest (i.e. endangered, vulnerable, rare or endemic in the European Community) whose conservation requires the designation of special areas of conservation. Bullhead is also a UK Biodiversity Action Plan (BAP) priority species.

- 4.3.11 White-clawed crayfish *Austropotamobius pallipes* are considered absent from the study area due to the presence of signal crayfish. Signal crayfish were observed in Moor Ditch at several locations.
- 4.3.12 Invasive Non-Native Species identified during surveys and desk study included Nuttall's waterweed *Elodea nuttallii*, Himalayan balsam, Asian clam *Corbicula fluminea*, Demon shrimp *Dikerogammarus haemobaphes*, Flatworm *Dugesia tigrine*, Caspian mud shrimp *Chelicorophium curvispinum*, signal crayfish, New Zealand pigmyweed *Crassula helmsii* and curly pondweed *Potamogeton crispus*.

WB6

- 4.3.13 Moor Ditch was surveyed from Ladygrove Bridge for 1.64 km to where a tributary joins the watercourse at NGR SU 53423 93110. Representative photographs are shown in Figure 4.5. This section of Moor Ditch is bordered on the left by grazing pasture and on the right by scrub and arable land. There is a sewage treatment works final effluent discharge point upstream of Ladygrove Bridge.
- 4.3.14 The watercourse is heavily modified at Ladygrove Bridge where a major bridge crossing and associated bank reinforcement are present. The channel has been historically straightened and there is a second road crossing at NGR SU 53021 92641.



Figure 4.5 Representative photographs of Moor Ditch at WB6

- 4.3.15 The channel width was variable across the surveyed reach, ranging from 1.5 m to 4 m and had an estimated average depth of 0.4 m (maximum 0.6 m). Downstream of the bridge the banks comprised earth and the right bank was higher than the left. Flow was 0.25 – 0.5 m/s with little habitat variability (run was the only habitat present).
- 4.3.16 The water was slightly turbid at some locations and the substrate was predominantly sand with silt and some exposed gravels. The bank structure was relatively complex with trees, scrub, reeds and broadleaved herbs. There was 2 – 3 m of scrub along

the right bank for the entire surveyed reach and intermittent broadleaved trees on the left. There was some erosion on the left bank.

- 4.3.17 A variety of macrophytes, typical of lowland rivers were present including fool's watercress, sedge *Carex* sp., submerged reeds, reedmace *Typha latifolia* and common club rush *Schoenoplectus lacustris*. Macrophytes, overhanging vegetation and woody debris provided instream habitat for fish and macroinvertebrates. Coarse fish of varying sizes were observed along the surveyed reach.
- 4.3.18 This section of Moor Ditch has the potential to support protected and/or notable species, due to its close proximity with the River Thames.

WB7

- 4.3.19 WB07 is an artificial lake located on the corner of Appleford Crossing, adjacent to a quarry and landfill site (Figure 4.6). There is no obvious inlet or outlet and no direct connection with Moor Ditch was observed.
- 4.3.20 The water was very clear and the substrate around the margins was composed of cobbles. The pond was approximately 243 x 157 m. There was a large amount of litter in the pond.
- 4.3.21 WB07 is bordered by scrub and immature trees with an area of bare gravel where the waterbody was surveyed. There was no visible inlet or outlet. Two invasive non-native species of macrophyte were observed at the site, New Zealand pigmyweed *Crassula helmsii* and Nuttall's waterweed *Elodea nuttallii*.
- 4.3.22 It is possible that this waterbody could support protected and/or notable species.



Figure 4.6 Representative photographs of an artificial lake near Moor Ditch at WB7

- 4.3.23 The CCI characterised the aquatic macroinvertebrate assemblage as having moderate (CCI: 12.1 & 13.4) conservation value. One Notable (but not RDB) species of beetle was recorded, *Berosus affinis*. Species from the family Coenagrionidae were recorded in Autumn and Spring/Summer. Species such as *Coenagrion pulchellum* are regarded as nationally rare or notable and are listed in the citation of the Cothill Fen SAC and SSSI. Little Wittenham SAC and SSSI is designated in part for the wide diversity of dragonflies and damselflies, including breeding populations of the brown hawker *Aeshna grandis*, migrant hawker *Aeshna mixta* and emperor dragonfly *Anax imperator*. Species from the family Aeshnidae were recorded in Autumn and Spring/Summer. Emperor dragonfly were recorded in Autumn.
- 4.3.24 The PSI score was indicative of heavily sedimented conditions (PSI: 1.8 & 1.9). The LIFE score suggests the aquatic macroinvertebrate community had a low sensitivity (LIFE: 5.7 & 5.9) to reduced flow conditions. The community assemblage indicates biological water quality was poor (WHPT ASPT: 4.0 & 4.2).

WB8

- 4.3.25 WB08 flows clockwise around the power station before joining Moor Ditch at the A4130 (Figure 4.7). At the time of survey, there was no access to the waterbody as it is within the security fence at the power station, however it was visible at some locations. A 1.25 km section of the watercourse was surveyed from a Public Rights of Way (PRoW) between NGR SU 51601 91567 and SU 51147 92339.
- 4.3.26 WB09 is a modified channel that has been realigned around the power station. An outfall was visible on the watercourse on the opposite side of the power station. The riparian area was relatively well developed along most of the surveyed reach with broadleaved trees and scrub. There were some areas with uniform, grassy banks as pictured below. It was not possible to collect physicochemical water quality data as the channel was within the security fence of the power station.
- 4.3.27 It is not possible to comment on the macrophyte assemblage or presence/absence of fish as the watercourse could not be accessed.
- 4.3.28 It is possible that this watercourse could contain protected and/or notable species.



Figure 4.7 Representative photographs of an unnamed ditch at WB8

WB9

- 4.3.29 Moor Ditch (WB09) flows east with Milton Park Estate on the right side of the channel and arable land on the left. The riparian area is vegetated with trees and scrub on the left bank for a width of approximately 5 m. A 500 m stretch of Moor Ditch (WB09) was surveyed from a PRow in Milton Park Estate.



Figure 4.8 Representative photographs of Moor Ditch at WB9

- 4.3.30 This section of the ditch is heavily modified, with multiple outfalls from the industrial estate located on the right bank. A major bridge has recently been installed with mammal passes on either side. Evidence of habitat management exists either side of the bridge where coir matting has been fixed to the banks to stabilise and encourage growth of riparian vegetation. There was some bank reinforcement in the form of sheet piling on the left bank for approximately 10 m.
- 4.3.31 The average wetted width was 2 m and maximum width was 6m at the bridge. The average channel depth was 0.25 m with an estimated maximum depth of 0.15 m at the bridge. There was little habitat variability as flow was homogeneous throughout, however features including overhanging vegetation and detritus were present. The substrate was composed of a thick layer of soft silt with a very small area of exposed gravel upstream of the bridge. The gravels may have been deposited as part of mitigation associated with the bridge. Gravel was absent from the rest of the surveyed reach. The banks were relatively steep throughout with the right bank higher than the left, to encourage floodwater into the adjacent field.
- 4.3.32 Fool's watercress was present in low abundance at an open section of the channel. No fish were observed during the survey.
- 4.3.33 It is possible that this section of Moor Ditch supports protected and/or notable species.

WB10

- 4.3.34 WB10 is a roadside drainage ditch that runs parallel to High Street in Milton (Figure 4.9). The waterbody begins at an outfall and runs north-south for approximately 160 m along High Street before joining Moor Ditch at NGR SU 48425 92046. Arable land lies to the west and Milton Estate to the east.
- 4.3.35 The channel is straightened along the roadside and the channel form is homogeneous throughout. There was no perceptible flow and the water was clear. The average wetted width was 1 m and depth 0.05 m. The substrate was comprised entirely of silt and was covered in leaf litter. The left banktop was vegetated with scrub and the right banktop was a concrete path.
- 4.3.36 No macrophytes were recorded in the channel and no fish were observed.
- 4.3.37 It is likely this ditch dries out during warm, dry weather and is not considered suitable habitat for protected and/or notable species



Figure 4.9 Representative photographs of an unnamed ditch Moor Ditch at WB10

WB11

- 4.3.38 This section of Moor Ditch is upstream of Milton Park Estate. The surveyed reach was approximately 200 m and was located between the A34 and High Street. WB11 flows through grazing pasture, arable fields and land dominated by scrub before passing below High Street.
- 4.3.39 The section adjacent to High Street is heavily modified with a concrete bank on the left. The rest of the channel was more naturalised with shallow, vegetated banks. There was little habitat variability in the surveyed reach and run was the only habitat type present. The substrate was predominantly soft silt with some gravels overlain with silt. The average wetted width was 2 m (maximum 4 m) and depth was 0.25 m (maximum 0.30 m). Riparian vegetation consisted predominantly of scrub on both banks, with trees scattered along the left bank.
- 4.3.40 Macrophytes were present throughout the waterbody and included starwort *Callitriche* sp., fool's watercress, sedge, water forget-me-not *Myosotis scorpioides*, reeds and grasses. No fish were observed during the walkover survey.
- 4.3.41 This section of Moor Ditch is likely to support protected and/or notable species



Figure 4.10 Representative photographs of an unnamed ditch Moor Ditch at WB11

- 4.3.42 WB12 to WB17 (cf. Figure 4.1) are located further north due to the order in which they were surveyed as different components of the Proposed Scheme were developed.

WB18

- 4.3.43 Waterbody 18 is a ponded area of water located next to the railway sidings leading into the Hanson quarry site (Figure 4.11). There is a culvert that opens up from beneath the railway and flows into the pond, it is not known if there is an outlet.
- 4.3.44 Several macrophytes were observed including duckweed *Lemna* sp., rush *Juncus* sp. and reedmace. There were trees growing in the pond, suggesting it periodically dries or the water level is normally much lower. No fish were observed during the

survey. The riparian area was composed of broadleaved trees, scrub and semi-improved grassland.

4.3.45 It is possible that this site has could support protected and/or notable species.



Figure 4.11 Representative photographs of a pond near Moor Ditch at WB11

4.3.46 The CCI characterised the aquatic macroinvertebrate assemblage as having low (CCI: 4.3) to moderate (CCI: 9.3) conservation value in spring and autumn respectively. Species from the family Coenagrionidae were recorded in Autumn and Spring/Summer. Species such as *Coenagrion pulchellum* are regarded as nationally rare or notable and are listed in the citation of the Cothill Fen SAC and SSSI. One individual from the Stratiomyidae family was recorded in Autumn. *Stratiomys chamaeleon* is noted under the Cothill Fen SAC and SSSI, which is uncommon and listed in the Red Data Book of Invertebrates.

4.3.47 The PSI score was indicative of heavily sedimented conditions (PSI: 0.0 & 14.3). The LIFE score suggests the aquatic macroinvertebrate community had a low sensitivity (LIFE: 5.8 & 6.0) to reduced flow conditions. The community assemblage indicates biological water quality was moderately impacted (WHPT ASPT: 4.6).

WB19

4.3.48 Waterbody 19 is a large pond located south of Appleford Crossing in a garden (Figure 4.12). The pond was approximately 100 x 50 m. It was not possible to assess the depth or substrate composition however, the margins were predominately silt. Dissolved oxygen was good at 75.3 %.

4.3.49 A number of macrophytes were recorded along the margins and in the water including reedmace, common reed and common club rush *Schoenoplectus lacustris*. No fish were observed during the survey. The riparian area was composed of scattered trees, tall herbs and scrub.

4.3.50 It is possible that this waterbody could support protected and/or notable species.



Figure 4.12 Representative photographs of a pond at WB19

4.3.51 The CCI characterised the aquatic macroinvertebrate assemblage as having moderate (CCI: 8.6) to high (CCI: 18.3) conservation value in spring and autumn respectively. One Notable (not RDB) species of beetle was recorded, *Peltodytes caesus*. *Peltodytes caesus* is classified as Nationally Scarce (neither Red List nor Near Threatened) which means it occurs in 16-100 hectads in Great Britain. Species from the family Coenagrionidae were recorded in Autumn and Spring/Summer. Species such as *Coenagrion pulchellum* are regarded as nationally rare or notable and are listed in the citation of the Cothill Fen SAC and SSSI. Little Wittenham SAC and SSSI is designated in part for the wide diversity of dragonflies and damselflies, including breeding populations of the brown hawker and migrant hawker. Species from the family Aeshnidae were recorded in Autumn.

4.3.52 The PSI score was indicative of heavily sedimented conditions (PSI: 2.5 & 5.6). The LIFE score suggests the aquatic macroinvertebrate community had a low sensitivity (LIFE: 5.5 & 5.9) to reduced flow conditions. The community assemblage indicates biological water quality was poor, polluted or impacted (WHPT ASPT: 4.0 & 4.2).

WB20

4.3.53 Waterbody 20 is an agricultural drainage ditch located in arable land. A short section approximately 10 m in length held water and the rest of the ditch was dry (Figure 4.13). The waterbody was located within a hedgerow and was heavily shaded. The substrate was composed of earth and was soft.

4.3.54 The CCI characterised the aquatic macroinvertebrate assemblage as having moderate (CCI: 9.0) conservation value. No protected or notable species were recorded.

4.3.55 The PSI score was indicative of slightly sedimented conditions (PSI: 71.4). The LIFE score suggests the aquatic macroinvertebrate community had a low sensitivity (LIFE: 5.0) to reduced flow conditions. The community assemblage indicates biological water quality was poor, polluted or impacted (WHPT ASPT: 4.2).



Figure 4.13 Representative photographs of a ponded ditch at WB20

WB21

- 4.3.56 Waterbody 21 is a series of ditches located in the Didcot A Power Station land (Figure 4.14). The ditches have been excavated to collect run off from the site during decommissioning. The ditches flow into one main ditch that eventually flows into Moor Ditch at approximate grid reference SU 50874 91719. One of the ditches was visibly turbid, with high levels of sediment. It was not possible to collect water quality readings at this site
- 4.3.57 There were stands of reedmace and other macrophytes in the largest ditch that flows into Moor Ditch. Vegetation was absent from the smaller waterbodies. No fish were observed during the survey.
- 4.3.58 It is unlikely this site supports protected and/or notable species due to water quality issues and continued disturbance from the earth works.





Figure 4.14 Representative photographs of ditches at WB21

WB22

- 4.3.59 This section of Moor Ditch is located within Didcot A Power Station. The waterbody is heavily modified and channelised through the site, with a concrete substrate and left bank (Figure 4.15). The bank profile is steep and high (approximately 5 m on left bank and 7 m on right bank). Sections of the ditch are culverted through the site. The average wetted width was 1.5 m and this was consistent throughout the site. Flow was 0.25 – 0.5 m/s and the water was clear. It was not possible to get water quality readings at the site.
- 4.3.60 Fool's watercress *Apium nodiflorum* was the only macrophyte observed and there is very limited habitat for fish as the channel is reinforced with concrete and culverts are present either end of the power station. The riparian area was limited to either grass or artificial material.
- 4.3.61 It is unlikely that this section of Moor Ditch supports any protected and/or notable aquatic species.



Figure 4.15 Representative photographs of a ditch at WB22

WB23

- 4.3.62 Waterbody 23 (Figure 4.16) is a small area of ditch that receives flow from a balancing pond located in a new housing estate (Great Western Park) south of the A4130. The waterbody exits a culvert under the A4130 where it is open for approximately 0.14 km before continuing under the A4130. The waterbody is parallel to the A4130 and is bordered by parkland to the south. The water was clear and flow was 0.1 – 0.25 m/s.



Figure 4.16 Representative photographs of a ditch at WB23

4.3.63 Reedmace, fool's watercress, willowherb *Epilobium* sp. and rush *Juncus* sp. were present throughout the channel, covering 90 % of the water. No fish were observed during the survey.

4.3.64 It is considered unlikely the site supports protected and/or notable species.

WB24

4.3.65 WB24, located at SU 50644 90985 is a balancing pond, assumed to discharge through a culvert beneath the A4130 and Milton Road and into Meadow Brook. There is no ecological connectivity with Meadow Brook, it is unlikely the site supports protected and/or notable species.

WB25

4.3.66 WB25, located at SU 48813 91369 is a small ditch, heavily overgrown to the extent that it could not be photographed.

4.3.67 The CCI characterised the aquatic macroinvertebrate assemblage as having low (CCI: 4.5) conservation value. No protected or notable species were recorded.

4.3.68 The PSI score was indicative of heavily sedimented conditions (PSI: 7.1). The LIFE score suggests the aquatic macroinvertebrate community had a low sensitivity (LIFE: 4.8) to reduced flows. The community assemblage indicates biological water quality was very poor (WHPT ASPT: 2.6).

WB26

4.3.69 WB26, located at Backhill Lane (SU 48875 91284) is a small ditch, heavily overgrown to the extent that it could not be photographed.

4.3.70 The CCI characterised the aquatic macroinvertebrate assemblage as having fairly high (CCI: 10.5) conservation value. No protected or notable species were recorded.

4.3.71 The PSI score was indicative of sedimented conditions (PSI: 28.6). The LIFE score suggests the aquatic macroinvertebrate community had a moderate sensitivity (LIFE: 6.6) to reduced flows. The community assemblage indicates biological water quality was poor, polluted or impacted (WHPT ASPT: 3.9).

Moor Ditch and Ladygrove Ditch Water Body Water Quality

- 4.3.72 A programme of water quality sampling was undertaken to inform the baseline, and included sampling locations on Moor Ditch, Meadow Brook and Stert Brook. The aim of the sampling was primarily to provide data to enable the assessment of routine road runoff and accidental spillages (HEWRAT and M-BAT analysis) to be undertaken (see Appendix 14.3). As such, the determinands focused on dissolved metals, dissolved calcium, pH, dissolved organic carbon (DOC) and total hardness. Site visits were undertaken on 3rd June 2020, 7th July 2020, 3rd August 2020 and 7th September 2020. Results are presented in Table 4-2.
- 4.3.73 The data shows that all of the watercourses monitored were slightly alkaline and across the monitored sites total hardness ranged between 275 and 403 mgCaCO₃/l, with Stert Brook having the highest average total hardness over the four visits (338.7 mgCaCO₃/l). Stert Brook had the highest DOC with a mean of 6.71 mg/l. Meadow Brook had the lowest DOC with a mean of 3.12 mg/l. Dissolved metals are generally low, however dissolved copper was somewhat elevated at all of the sites, with mean values ranging between 2.95µg/l in Stert Brook to 4.05µg/l in Moor Ditch.
- 4.3.74 The EA's Water Quality Archive website³ also contains surface water quality data for the Moor Ditch. Summary water quality data for the years 2009 – 2019 is presented in ES Appendix 14.5: Water Quality Data Tables. Samples on Moor Ditch are regularly taken above Didcot Sewage Treatment Works (STW) (NGR: SU 51599 91495) and at the B4016 in Appleford (NGR: SU 53032 92646).
- 4.3.75 Above the STW, the data indicated Moor Ditch to be slightly alkaline and well oxygenated. Concentration of nitrates and phosphate are lower than expected considering the main land use is agriculture although still somewhat elevated. Data from prior to 2008 showed elevated metal concentrations (e.g. copper and zinc).
- 4.3.76 Downstream of the STW and Southmead industrial estate at Appleford, the water quality appears to deteriorate, with increased concentrations of nitrogen compounds, which are in more than double the concentration of those measured upstream. Concentrations of phosphorus are also higher, while levels of oxygen are slightly less. The concentration of copper and zinc are high with 10th percentile values of 2.74µg/l and 8.33µg/l, respectively. For a full summary of the data refer to ES Appendix 14.5: Water Quality Data Tables.

³ <https://environment.data.gov.uk/water-quality/view/landing>. Accessed July 2022.

Table 4-2: Results of water quality sampling on the Moor Ditch and Ladygrove Ditch WFD waterbody

Determinand	Units	Limit of Detection	WFD EQS	Moor Ditch (SU 48760 92010)			Start Brook (SU 49480 91430)			Meadow Brook (SU 50910 64160)		
				Min	Max	Mean	Min	Max	Mean	Min	Max	Mean
pH	pH Units	N/A		8.1	8.90	8.33	8.2	8.4	8.25	8.2	8.4	8.27
DOC	mg/l	0.1		2.59	2.59	3.65	4.9	7.65	6.71	2.59	3.47	3.12
Hardness - Total	mgCaCO ₃ /l	1		275	275	291.33	306	369	338.67	310	403	356.5
Arsenic (dissolved)	µg/l	0.15	50 (long term average)	1.72	2.3	2.07	4.72	6.57	5.70	2.74	3.47	3.105
Cadmium (dissolved)	µg/l	0.02	0.25*	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Calcium (dissolved)	mg/l	0.012		88	120	109.50	110	140	130	120	160	143.33
Chromium (dissolved)	µg/l	0.2	3.4 (long term mean)	<0.2	0.3	0.30	0.3	0.4	0.35	<0.2	<0.2	<0.2
Copper (dissolved)	µg/l	0.5	1 (bioavailable – long term mean)	2.9	5.5	4.05	2.1	4.4	2.95	2.2	5.1	3.33
Lead (dissolved)	µg/l	0.2		<0.2	<0.2	<0.2	0.3	0.9	0.53	0.5	0.5	0.5
Magnesium (dissolved)	mg/l	0.005		3	13	5.65	3.7	5.4	4.6	3.8	4.6	4.2
Mercury (dissolved)	µg/l	0.05	0.07**	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Nickel (dissolved)	µg/l	0.5	4*	1	2.2	1.375	2.9	6	4.1	1.6	2.5	2
Selenium (dissolved)	µg/l	0.6		0.6	0.7	0.65	0.7	0.9	0.77	0.8	1.1	0.93
Zinc (dissolved)	µg/l	0.5	10.9 + ambient for the catchment (bioavailable) *	1.8	2.1	2	1	6.9	2.75	1.4	3.6	2.67

*AA = Annual Average (AA) EQS, **MAC = Maximum Allowable Concentration (MAC) EQS

4.4 Thames (Evenlode to Thame) WFD Water Body (River Thames)

WFD Classification and Proposed Mitigation Measures

- 4.4.1 The River Thames in the study area is the Thames (Evenlode to Thame) (GB106039030334) water body of the Thames RBMP. WFD data in Table 4-3 are summarised from the EA's Catchment Data Explorer⁴.
- 4.4.2 The connecting waterbody downstream is Thames Wallingford to Caversham (GB106039030331) which is approximately 5 km downstream of the Scheme.

Table 4-3: Summary of WFD quality elements for the River Thames (Thames (Evenlode to Thame)) water body

WFD Parameter	Status/ Summary
Water Body ID	GB106039030334
Water Body Name	Thames (Evenlode to Thame)
Water Body Type	River
Water Body Length / Area	63.863 km/ 14.959 km ²
Hydromorphological Designation	Not designated artificial or heavily modified
Overall Ecological Status	Moderate in 2015 (RBMP cycle 2); Moderate in 2019 (most recent data)
Current Overall Status	Moderate in 2015 (RBMP cycle 2); Moderate in 2019 (most recent data)
Status Objective (overall)	Moderate in 2015 (Unfavourable balance of costs and benefits; disproportionate burdens; no known technical solution is available)
Biological Quality Elements	Moderate due to invertebrates and fish in 2015. Monitoring data suggests an improvement in fish to Good in 2019. Suspected presence of North American Signal Crayfish - an invasive non-native species is preventing invertebrates from being considered Good.
Physico-chemical Quality Elements	Moderate in 2015 and 2019, due to Phosphates associated with point source pollution from continuous sewage discharge and diffuse source pollution from poor nutrient management and poor livestock management. High quality conditions for other measured variables.
Hydromorphological Quality Elements	Supports Good
Chemical	Fail in 2015 and 2019 due to three priority hazardous substances; Polybrominated diphenyl ethers (PBDE), Perfluorooctane sulphonate (PFOS), and Mercury (Fail).
RBMP Priority Issues for the Ock Operational Catchment	Improve the status of invertebrates and engaging landowners to adjust land management practices to reduce diffuse pollution.

Thames Local Hydromorphology

- 4.4.3 At the proposed location of the Scheme crossing the River Thames occupies a single thread channel of approximately 40 m width (Figure 4.17). The channel has been

⁴ <https://environment.data.gov.uk/catchment-planning/WaterBody/GB106039030334>. Accessed May 2021.

realigned historically over several kilometres, is impounded and regulated for navigation. This results in a low energy almost laminar flow, with little of the flow dynamics that would otherwise be present in a well-developed floodplain river. According to the National River Flow Archive website (accessed March 2021) it has a Q95 flow (i.e. flow that is exceeded 95% of the time) of 2.5 m³/s. The River Thames is well connected to its floodplain, although channel modifications suggested lower connectivity than would occur naturally. Water depths meant that the bed was not visible, but no riffles, pools or point bars were evident due to the navigation impoundment. Silt appears excessive in the modified flow regime and due to catchment land uses.



Figure 4.17: River Thames at the proposed Scheme crossing

Thames Local Aquatic Ecology

- 4.4.4 The surveyed stretch of the River Thames was generally unmodified and in a semi-natural condition. The character of the river was similar either side of the Scheme crossing point and the river had a well-developed riparian area with mature willow and alder trees for most of the surveyed stretch. There were overhanging boughs along the river margins, providing habitat diversity and allochthonous inputs to the river.
- 4.4.5 The current WFD status of the River Thames (Evenlode to Thame) is Moderate overall, with Ecological status Moderate and Chemical status Fail. The aquatic macroinvertebrate community was characteristic of moderate to good biological water quality across summer and autumn.
- 4.4.6 European eel is known to be present in the River Thames, which is a species of principal importance. Brown trout is also recorded in the River Thames and likely to be present in the study area.
- 4.4.7 Three aquatic macroinvertebrates, (refer to ES Chapter 9: Biodiversity) species of conservation interest (although not protected) were recorded: trumpet ramshorn snail and two species of water scavenger beetle (*Berosus affinis* and *Peltodytes caesus*). These species are Notable (not RDB) under the CCI. *Peltodytes caesus* is classified as Nationally Scarce. White-clawed crayfish *Austropotamobius pallipes* are considered absent from the study area due to the presence of signal crayfish.
- 4.4.8 No wetland plant or aquatic macrophyte species were recorded that are afforded statutory protection.
- 4.4.9 INNS identified during surveys and desk study included Nuttall's waterweed, Himalayan balsam, Asian clam, Demon shrimp, Flatworm *Dugesia tigrine*, Caspian mud shrimp, signal crayfish, New Zealand pigmyweed and curly pondweed.
- 4.4.10 WB01 to WB02 (cf. Figure 4.1) are located outside of the Proposed Scheme boundary in Roundhill Wood north of Clifton Hampden. Both are up-gradient and upstream of the Proposed Scheme and therefore are not considered to be at risk and have not been assessed further.

WB03

- 4.4.11 WB03 is an agricultural drainage ditch (Figure 4.18) located in arable land to the south of Roundhill Wood. WB03 flows east from NGR SU 54571 96130 before flowing through a culvert and diverting south along a field boundary at NGR SU 54719 91630. Only the eastwest section of the ditch could be accessed from a PRow where a 140m section of the watercourse was surveyed.
- 4.4.12 WB03 was dry at the uppermost section and where water was present it was very shallow (average depth of 0.05 m, maximum 0.07 m). The water was not deep enough to collect physico-chemical water quality readings. There was very little flow in the eastwest section of the ditch and the substrate was composed of earth. Flow increased in the north-south section where exposed gravels were present. The banks were very steep (80-90°) and were moderately diverse with trees, grasses and scrub. The average flow was estimated at less than 0.10 m/s.
- 4.4.13 Terrestrial vegetation (willowherb *Epilobium* sp., brambles, willow *Salix* sp., and oak *Quercus* sp.) was choking the east-west channel and heavily shading the water. Broadleaved trees and scrub bordered the north-south channel and the bankface was bare in places.
- 4.4.14 Aquatic macrophytes were absent from the channel, suggesting the ditch dries out during period of dry weather. No fish were observed.
- 4.4.15 WB03 is unlikely to support protected and/or notable aquatic species.



Figure 4.18: Ditch in the River Thames catchment area near the Proposed Scheme crossing

WB04

- 4.4.16 WB04 is a tributary of the River Thames and could only be accessed along the A415 where it passes beneath the road in a culvert (Figure 4.19). Upstream of the survey site the land is predominantly arable and downstream it flows through a small area of woodland before entering the River Thames approximately 200 m downstream.
- 4.4.17 This section of the waterbody is heavily modified with concrete reinforcement on the left-hand bank where it enters the culvert. The substrate comprised earth, gravel and silt with estimated average flows of 0.10 – 0.25 m/s upstream of the culvert and less than 0.10 m/s downstream where the channel widens. The average wetted width was 1 m and channel depth was 0.10 m.
- 4.4.18 Terrestrial vegetation (grasses, nettles and ivy *Hedera* sp.) was growing in the channel downstream of the culvert, suggesting the channel is dry for sustained periods. No aquatic macrophytes or fish were observed during the walkover.
- 4.4.19 It is not possible to comment on the quality of aquatic habitats in WB04 as access was limited. It is considered unlikely that this waterbody could support protected and/or notable species.



Figure 4.19: Local (partly dry) tributary to the River Thames near the Proposed Scheme

WB05

- 4.4.20 WB05 is a roadside drainage ditch that flows along a farm track, south of the A415. The ditch flows east-west before joining an unnamed tributary of the River Thames. A 400 m section of the ditch was surveyed from a PRow. WB05 had an average wetted width of 1 m (maximum 3.5 m) and depth of 0.15 m (maximum 0.50 m). The channel became wider towards the end of the surveyed reach and the habitat changed from a run to having no perceptible flow. The water was slightly turbid and the substrate was predominantly soft silt with a small amount of gravel. The banks were steep and generally covered with scrub. There was a hedgerow running along the left bank which had recently been cut back and there was one minor pedestrian bridge crossing. The average flow was estimated at less than 0.10 m/s.
- 4.4.21 Several species of macrophyte were present including fool's watercress *Apium nodiflorum*, brooklime *Veronica beccabunga* and gypsywort *Lycopus europaeus*. Overall macrophyte cover was approximately 15 % of the surveyed reach and overhanging riparian vegetation was present for approximately 30 %. Detritus was abundant and there was some woody debris. No fish were observed during the walkover survey.
- 4.4.22 It is possible this waterbody supports protected and/or notable species.



Figure 4.20: Ditch in the River Thames catchment area near the Proposed Scheme

- 4.4.23 WB12, WB13 and WB14 (cf. Figure 4.1) were visited in the course of baseline surveys, but lie outside the Proposed Scheme red line boundary, and have no visible connectivity to the River Thames or its tributaries, so have not been assessed further.

WB15

- 4.4.24 This section of the River Thames is north of Appleford Road at the crossing point of the proposed Scheme (Figure 4.21). The adjacent land is used for arable crops and the Thames path runs along the northern side of the river. The average wetted width was 20 m and glide was the predominant habitat type. It was not possible to estimate depth or substrate composition. The Thames is well connected to its floodplain in this location and a series of wetlands exist to the south
- 4.4.25 No macrophytes or fish were observed during the survey. The riparian area was covered with scattered broadleaved trees, scrub and grasses.
- 4.4.26 There are recent desk study records of protected fish (European eel and brown/sea trout) in the River Thames located close to the survey location.



Figure 4.21: River Thames at the proposed Scheme crossing

WB16

- 4.4.27 Waterbody 16 is a wetland area (Figure 4.22) to the south of the River Thames and lies within the floodplain. The area is part of the restoration plan for the Hanson quarry site. At the time of survey, it was evident restoration works were still underway. The area is not directly connected to the River Thames, and is presumably supplied from subsurface groundwater connectivity, although a large fluvial event could also inundate the area. The surrounding land was semi-improved grassland with some scrub and shrubs around the margins of the waterbody. It was not possible to access the water to collect water quality readings.
- 4.4.28 There were some reeds present in the waterbody and large flocks of birds were observed around the wetland area. It likely that this site could support protected and/or notable species, but in WFD terms, being an artificial gravel pit in the River Thames floodplain, it has no ecological connection to the River Thames watercourse.



Figure 4.22: Flooded gravel pits next to the River Thames near the proposed Scheme crossing

WB16

- 4.4.29 Waterbody 16 is a fish pond located at SU 52398 93544 adjacent to Appleford railway station. It is an artificial gravel pit some 500m from the River Thames, presumably supplied by groundwater, with no open channel connectivity to the Thames.

4.5 Groundwater (Vale of White Horse Chalk Groundwater Body)

- 4.5.1 The nearest part of the nearest groundwater body, the Vale of White Horse District Council (VoWHDC) Chalk Groundwater Body GB40601G60100, is to the south of the A4130, and does not underly the Scheme. The waterbody is at Poor Status, with Poor Chemical status and Good GW Quantitative Status elements respectively. Local groundwater conditions are summarised below, suggesting limited connectivity to the WFD groundwater body.
- 4.5.2 **A4130 Widening:** The superficial geology in the study area comprises mostly secondary undifferentiated head deposits, although there is also some Secondary A (Alluvium) to the north. The bedrock geology comprises mostly of the Gault Formation, which is designated as unproductive strata.
- 4.5.3 **Didcot Science Bridge:** There are two members of the secondary A aquifer separated by the secondary undifferentiated head deposits near the power station. The Summertown-Radley sand and gravel are located to the west of the power station and to the east is the Wolvercote sand and gravel. The bedrock geology comprises of mostly the Gault Formation, which is designated as unproductive strata.
- 4.5.4 **Didcot to Culham River Crossing:** The superficial geology in the study area comprises secondary A deposits with predominantly Northmoor Sand and Gravel Member Lower Facet, although there is also some Wolvercote sand and gravel member towards the south and Alluvium along the River Thames. The bedrock geology comprises mostly of the Gault Formation, which is designated as unproductive strata, with some Lower Greensand Formation which is designated as a Secondary A aquifer towards the A415 to the north of the crossing. The groundwater vulnerability is described as a minor aquifer with medium vulnerability in most areas, however vulnerability increases to high around the River Thames.
- 4.5.5 **Clifton Hampden Bypass:** The superficial geology in the study area comprises secondary A deposits with Summertown-Radley sand and gravel member. The bedrock geology comprises of the Lower Greensand Group which is designated as a Secondary A aquifer. The groundwater vulnerability in the area is described as a minor aquifer with medium vulnerability in most areas, however vulnerability increases to high to the north of the A415 and around the River Thames.
- 4.5.6 The superficial deposits present in the study area are Secondary Aquifers. Lower Greensand Formation aquifers at the Didcot to Culham River Crossing and the Clifton Hampden Bypass are associated with alluvial and terrace gravel deposits. These are permeable layers with a moderate to high primary permeability, capable of supporting water supplies and minor channel habitats at a local rather than strategic scale.
- 4.5.7 Secondary (undifferentiated) aquifers are associated with the head deposits present across the study area. These aquifers are defined where it has not been possible to provide an A or B category, but groundwater – surface water connectivity is likely to be limited.

- 4.5.8 There are no groundwater Source Protection Zones in the study area and no groundwater abstractions have been identified within 1km of the site. The site is however, located within a Nitrate Vulnerable Zone.

5. Screening Assessment

5.1 Water Bodies Screened In

5.1.1 The Scheme crosses several WFD surface water bodies, which are therefore screened into this WFD assessment. Local watercourse names for the WFD water bodies are summarised in Table 5.1.

Table 5-1: WFD water bodies crossed by The Scheme

Local Watercourse Name	WFD Water Body Name	WFD Operational Catchment	WFD Management Catchment	WFD River Basin District	WFD River Basin Management Plan
Meadow Brook	Moor Ditch and Ladygrove Ditch	Ock	Gloucestershire and the Vale	Thames	Thames
Stert Brook					
Cow Brook					
Moor Ditch					
A4130 Southern Ditch					
Ditch Adjacent to Backhill Lane					
River Thames	Thames (Evenlode to Thame)				

5.2 Water Bodies Screened Out

5.2.1 The Scheme crosses an area of permanent aquatic habitat in the River Thames floodplain known as the Hanson finger lakes, which is the subject of ongoing aquatic and terrestrial habitat restoration by Hanson Aggregates. In the Thames RBMP, the Hanson finger lakes are not classified as WFD lakes, and therefore they are not assessed in this WFD assessment.

5.2.2 It is emphasised that the Scheme places high value on the Hanson finger lakes, which are classified as Habitat of Principal Importance of Eutrophic Standing Water (refer to ES Chapter 9: Biodiversity). The area is subject to detailed impact and mitigation planning in accordance with the ecological and biodiversity objectives of the Scheme. This includes integration of Hanson Aggregates' ongoing restoration plans with the effects of the Scheme, and ongoing consultation between Hanson Aggregates, OCC, AECOM, the EA and Natural England. This is being delivered through habitats, ecology and biodiversity legislation rather than the WFD.

5.2.3 The Scheme affects several other small ponds in the southerly River Thames floodplain that are not WFD lakes and therefore screened out of this assessment. These are also managed for the Scheme under habitats, ecology and biodiversity legislation.

5.2.4 The Scheme crosses numerous surface drainage ditches, including those parallel to the existing A4130, and numerous ditches crossed by the route of the Clifton Hampden Bypass. These ditches are artificial features that are typically dry and are not aquatic habitats, so they are also screened out of the assessment.

5.2.5 In summary, and with reference to the aquatic ecology sampling locations shown in Figure 4.1, the ponds and dry or ephemeral watercourses and ditches that are within the vicinity of the Proposed Scheme, but have been screened out of WFD assessment, are summarised in Table 5-2. Perennial waterbodies that are screened in to WFD assessment are also listed.

5.2.6 Additionally, the following potential WFD impact pathways to connecting water bodies have been screened out of the assessment as follows:

- Ginge Brook and Mill Brook (GB106039023660) are tributaries of the River Thames that flow from the confluence (SU 4792 9870) of Mill Brook (an Ordinary Watercourse) and Ginge Brook (a Main River). These waterbodies are scoped out because they are upstream of the proposed River Thames crossings.
- An unnamed watercourse upstream of Moor Ditch to the east of the railway line has been scoped out of the assessment since it will not be impacted by the alignment of the Scheme.
- Several Ordinary Watercourses to the south of Long Wittenham have been scoped out as they are not crossed by the Scheme. The Scheme does not overlie any WFD groundwater body, although local groundwater risks and connections to and between surface water bodies have been assessed (refer to ES Chapter 14: Road Drainage and the Water Environment). The VoWHDC Chalk groundwater body is a short distance (ca. 300 m) from the south-east boundary of the Scheme at the A4130, but ground generally rises to the south-east and it is considered that there are no significant risks from the Scheme to the water body.

Table 5-2 Water Feature WFD Screening Summary

WFD Water body	Local Watercourse Name and Feature Type	Aquatic Ecology Sampling Location	Screen In or Out?	Justification
Thames (Evenlode to Thame) Water Body	Unnamed ditch	WB01	Out	Forestry ditch with no obvious tributary connection to the River Thames. Outside and upslope of the Proposed Development boundary, and not at risk.
Thames (Evenlode to Thame) Water Body	Unnamed ditch	WB02	Out	Forestry ditch with no obvious tributary connection to the River Thames. Outside and upslope of the Proposed Development boundary, and not at risk.
Thames (Evenlode to Thame) Water Body	Unnamed ditch	WB03	Out	Agricultural ditch, ephemeral, mainly dry, not considered suitable habitat for protected and/or notable species
Thames (Evenlode to Thame) Water Body	Unnamed ditch	WB04	Out	Ephemeral, partly dry, presumably artificially deepened and extended if it had natural origins. Not considered suitable habitat for protected and/or notable species
Thames (Evenlode to Thame) Water Body	Unnamed ditch	WB05	Out	Highway ditch, ephemeral, only connects to the Thames via another unnamed tributary which appears partly dry from aerial images. Not considered to be a connected habitat to the Thames.
Moor Ditch and Ladygrove Ditch Water Body	Moor Ditch (river)	WB06	In	Aquatic habitat
n/a (although in Moor Ditch and Ladygrove Ditch Water Body catchment area)	Unnamed artificial lake	WB07	Out	Not a WFD water body, no observed connection to other water features
Moor Ditch and Ladygrove Ditch Water Body	Unnamed watercourse (river)	WB08	In	Aquatic habitat, included as tributary of Moor Ditch
Moor Ditch and Ladygrove Ditch Water Body	Moor Ditch (river)	WB09	In	Aquatic habitat
Moor Ditch and Ladygrove Ditch Water Body	Unnamed ditch	WB10	Out	Artificial highway drain, ephemeral, not considered suitable habitat for protected and/or notable species
Moor Ditch and Ladygrove Ditch Water Body	Moor Ditch (watercourse)	WB11	In	Aquatic habitat
Thames (Evenlode to Thame) Water Body	Unnamed ditch	WB12	Out	Outside the Proposed Scheme red line boundary, and have no visible connectivity to the River Thames or its tributaries
Thames (Evenlode to Thame) Water Body	Unnamed ditch	WB13	Out	Outside the Proposed Scheme red line boundary, and have no visible connectivity to the River Thames or its tributaries

WFD Water body	Local Watercourse Name and Feature Type	Aquatic Ecology Sampling Location	Screen In or Out?	Justification
Thames (Evenlode to Thame) Water Body	Unnamed ditch	WB14	Out	Outside the Proposed Scheme red line boundary, and have no visible connectivity to the River Thames or its tributaries
Thames (Evenlode to Thame) Water Body	River Thames	WB15	In	Aquatic habitat
n/a (although within Thames (Evenlode to Thame) Water Body	Hansen Gravel Pits / Finger Lakes	WB16	Out	Artificial lake in Thames floodplain, but with no connectivity with the river other than via groundwater or fluvial inundation
n/a (although within Thames (Evenlode to Thame) Water Body catchment area)	Unnamed pond	WB17	Out	Not a WFD water body, some habitat value, but no observed connection to other water features
n/a (although in Moor Ditch and Ladygrove Ditch Water Body catchment area)	Unnamed pond	WB18	Out	Not a WFD water body, some habitat value, but no observed connection to other water features
n/a (although in Moor Ditch and Ladygrove Ditch Water Body catchment area)	Unnamed pond	WB19	Out	Not a WFD water body, some habitat value, but no observed connection to other water features
Moor Ditch and Ladygrove Ditch Water Body	Unnamed ditch	WB20	Out	Artificial agricultural ditch, ephemeral, mainly dry, not considered suitable habitat for protected and/or notable species
Moor Ditch and Ladygrove Ditch Water Body	Unnamed ditch	WB21	Out	Artificial ditches in the former power station cut for decommissioning. Ephemeral, partly dry. Some connectivity to Moor Ditch, but not considered suitable habitat for protected and/or notable species
Moor Ditch and Ladygrove Ditch Water Body	Moor Ditch (river)	WB22	In	Aquatic habitat
Moor Ditch and Ladygrove Ditch Water Body	Unnamed ditch	WB23	Out	Artificial ditch linked with housing estate balancing pond. Ephemeral, partly dry. No significant connectivity to Moor Ditch, not considered suitable habitat for protected and/or notable species
n/a (although in Moor Ditch and Ladygrove Ditch	Unnamed pond	WB24	Out	Balancing pond discharging to long culvert outflow. Ephemeral, partly dry. No significant connectivity to Meadow Brook or Moor Ditch, not

WFD Water body	Local Watercourse Name and Feature Type	Aquatic Ecology Sampling Location	Screen In or Out?	Justification
Water Body catchment area)				considered suitable habitat for protected and/or notable species
Moor Ditch and Ladygrove Ditch Water Body	Unnamed ditch	WB25	Out	Artificial highway drain, ephemeral, not considered suitable habitat for protected and/or notable species
Moor Ditch and Ladygrove Ditch Water Body	Unnamed ditch	WB26	Out	Artificial highway drain, ephemeral, not considered suitable habitat for protected and/or notable species

5.3 WFD Low Risk Activity Screening

- 5.3.1 Low risk WFD activities are summarised in Table 3.1. These are typically temporary work or maintenance activities for existing structures, but significantly, low risk activities also include permanent clear span bridges with abutments set-back from the bank top.
- 5.3.2 On the basis of Table 3.1, the proposed watercourse activities in the Moor Ditch and Ladygrove Ditch water body are not considered to be low risk activities, so these are screened in Scheme Element WFD Screening.
- 5.3.3 The clear span crossing of the River Thames is considered to be a low risk activity, so is screened out at this point, for the reasons summarised below.
- 5.3.4 The General Arrangement drawings submitted with the planning for the proposed crossing of the River Thames are reproduced in Figure 5.1. Low risk activity screening for the proposed crossing of the River Thames is summarised in Table 5-3.
- 5.3.5 The design elements pertinent to WFD and low risk activities associated with the River Thames crossing are as follows:
- The crossing of the main channel is a clear span of approximately 65 m compared with an approximate 40 m banktop channel width.
 - There are no abutments close to banktop, and the nearest viaduct piers are set back at least 7 m.
 - The deck invert is approximately 4.1 m above the typical water level, as determined from the standard headwater elevation at Clifton Lock (46.802 m AOD). This is for navigation clearance as well as freeboard above flood levels. The deck invert is approximately 600 mm above the modelled 1% Annual Exceedance Probability (AEP) flood level.

Table 5-3: WFD Low Risk Activity Screening

Scheme Area	WFD Water Body	Watercourse - Aquatic baseline	Structure name	Culvert Type	Centroid Grid Reference	Dimensions (Width x Height) (approx.)	Length (m) (approx.)	Screen In or Out	Screening Justification
River Thames Crossing	Thames (Evenlode to Thame)	River Thames	River Thames Crossing	Clear span bridge	451969,194470	17.9 x 4.7 (nominal)	65 m main span across 40 m wide river	Screen Out	Aquatic and high value habitat, but the proposed crossing is clear span bridge with deck level high above water. This is a WFD low risk activity – refer to Table 3-1.

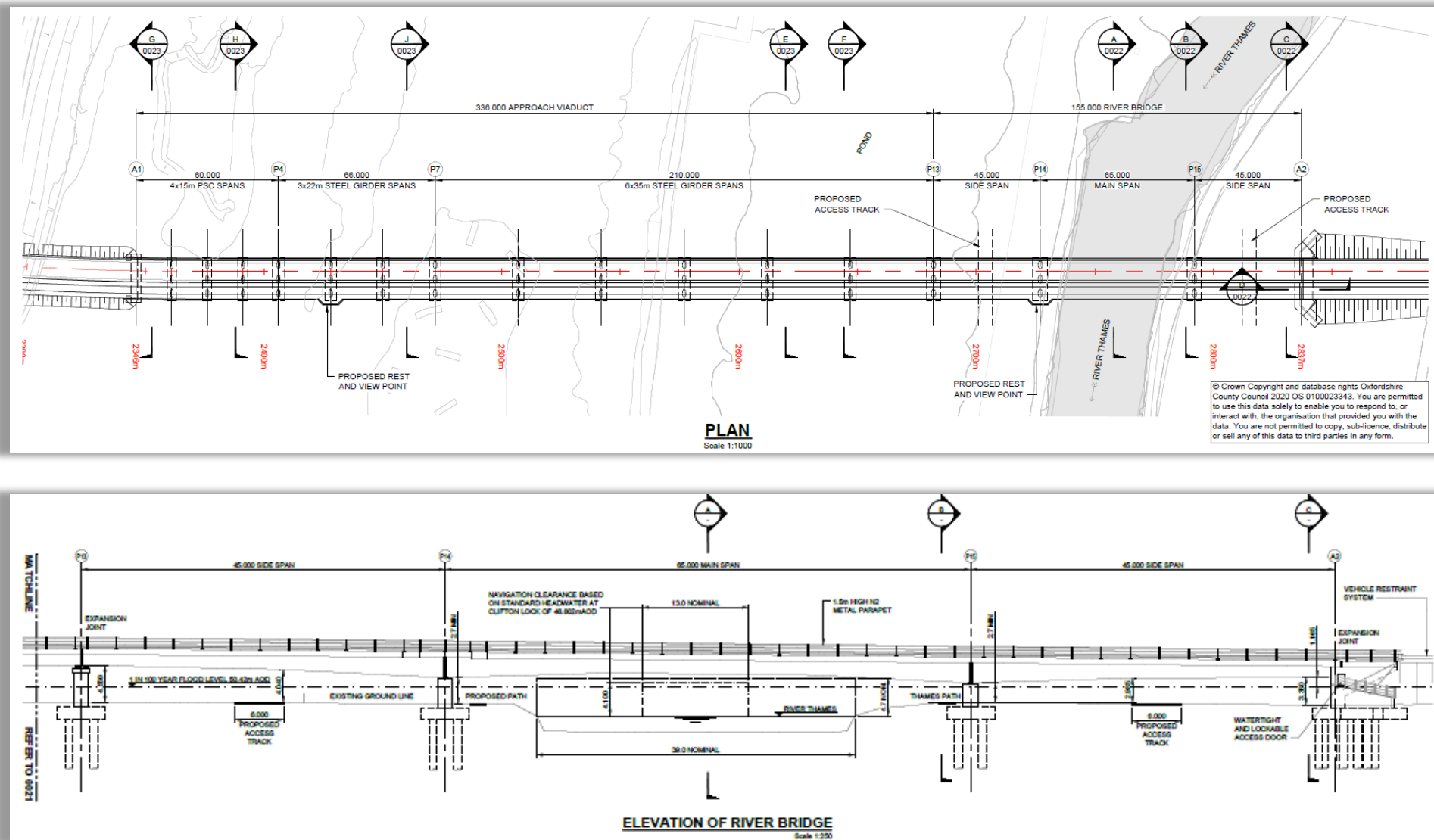


Figure 5.1: Excerpts of the River Thames crossing general arrangement drawings (May 2021)

5.4 Statutory Designated Site WFD Screening

- 5.4.1 The Scheme does not cross any sites statutorily designated for biodiversity value. However, the ES Chapter 9: Biodiversity identifies several statutory sites within the potential zone of influence of the Scheme. These are screened for WFD quality elements in Table 5-4.
- 5.4.2 In summary, Table 5-4 indicates that no WFD objectives at statutory designated sites are at risk from the Scheme.

Table 5-4: WFD screening of statutory designated sites in the vicinity of the Scheme

Statutory Site Name	Reason(s) for Designation	Distance (km) and direction to closest point of Scheme; and relationship to the Scheme (approx.)	WFD Screening
Culham Brake Site of Special Scientific Interest (SSSI)	National – SSSI. Small area (1.5 ha) of willow carr by the Thames contains one of the largest British populations of a Red Data Book species, Summer Snowflake <i>Leucojum aestivum</i> .	1.2 km north-west of Didcot to Culham River Crossing. Upstream from the Scheme boundary, so unlikely to be affected. No designated features that are also WFD quality elements.	Screen Out
Little Wittenham SAC (and SSSI)	International – SAC. Site supports one of the largest known breeding populations of Great Crested Newt <i>Triturus cristatus</i> in the UK. The site also supports an outstanding breeding assemblage of other amphibians (which includes Smooth Newt <i>Lissotriton vulgaris</i> , Common Frog <i>Rana temporaria</i> and Common Toad <i>Bufo bufo</i>) and of dragonflies and damselflies.	3.1 km south-east of Clifton Hampden Bypass. Wetlands are directly connected to the River Thames and downstream from the Scheme. No designated features that are also WFD quality elements. The Thames river crossing is a low risk to WFD elements.	Screen Out
Cothill Fen SAC (and SSSI)	International – SAC. Lowland valley mire contains one of the largest surviving examples of alkaline fen vegetation in central England, a region where fen vegetation is rare.	6.7 km north-west of Didcot to Culham River Crossing. No ecological connections between the SAC/SSSI and the Scheme.	Screen Out

5.5 Non-Statutory Designated Site WFD Screening

- 5.5.1 The Scheme does not cross any sites non-statutorily designated for biodiversity value. However, ES Chapter 9: Biodiversity identifies several statutory sites within the potential zone of influence of the Scheme. These are screened for WFD quality elements in Table 5-5.

In summary, Table 5-5 indicates that no WFD objectives at non-statutory designated sites are at risk from the Scheme.

Table 5-5: WFD screening of non-statutory designated sites in the vicinity of the Scheme

Non-statutory Site Name	Reason(s) for Designation	Distance (km) and direction to closest point of Scheme; and relationship to the Scheme (approx.)	WFD Screening
Furze Brake Local Wildlife Site (LWS)	Furze Brake is set on a gentle south-facing slope to the southwest of Abingdon. This site houses the most important heronry in the upper Thames basin, with nearly 50 active nests. The woodland is predominantly Oak <i>Quercus</i> sp. and Ash <i>Fraxinus excelsior</i> and there are a range of other species present, with plentiful Birch <i>Betula</i> , Wild Cherry <i>Prunus avium</i> , Rowan <i>Sorbus aucuparia</i> and Hornbeam <i>Carpinus betulus</i> . The understorey is quite rich with Spindle <i>Euonymus europaeus</i> and Buckthorn <i>Rhamnus</i> sp., while the ground flora includes abundant Bluebells <i>Hyacinthoides non-scripta</i> with Dog's mercury <i>Mercurialis perennis</i> and Moschatel <i>Adoxa moschatellina</i> . Yellow-star-of-Bethlehem <i>Gagea lutea</i> , which is rare in southern England, has been recorded in the past.	0.2 km north-east of Clifton Hampden Bypass. There are ecological connections between the LWS and the Site area, but there are no designated features that are also WFD quality elements.	Screen Out
Thames Clifton to Shillingford Conservation Target Area (CTA)	Area includes remnants of lowland meadow, wet meadow, small areas of wet woodland, woodland, some limestone grassland and patches of fen habitat. Also includes four gravel pits with eutrophic standing water that is important for wintering wildfowl and breeding Great Crested Newts.	0.4 km south of Clifton Hampden Bypass. The CTA includes wetland directly connected to the River Thames and is downstream from the Scheme. No designated features that are also WFD quality elements. The Thames river crossing is a low risk to WFD elements.	Screen Out
Clifton Hampden Wood LWS	This site is part of a narrow strip of woodland on the northern bank of the River Thames between Clifton Hampden and Burcot. The woodland is mainly wet Ash woodland on the level area near the river, with Beech <i>Fagus sylvatica</i> , Sycamore <i>Acer pseudoplatanus</i> Scots Pine <i>Pinus sylvestris</i> , Pedunculate Oak <i>Quercus robur</i> , Field Maple <i>Acer campestre</i> and Horse Chestnut <i>Aesculus hippocastanum</i> on the steeper bank. Crack Willow <i>Salix fragilis</i> and Alder <i>Alnus glutinosa</i> are found beside the river. An important feature of the woodland is the population of the nationally rare Loddon lily (or summer snowflake) comprising perhaps 2,000 - 3,000 mature plants near the river. The Loddon lily population appears healthy with many seedlings. Wet woodland is a priority habitat for conservation in the UK.	0.4 km east of Clifton Hampden Bypass. The LWS is downstream of the Scheme and includes wet woodland directly connected to the River Thames. No designated features that are also WFD quality elements. The Thames river crossing is a low risk to WFD elements.	Screen Out
Clifton Hampden Meadows LWS	Two meadows adjacent to the Thames, consisting of a mosaic of dry rough grassland, swamp and wet grassland areas. Areas of the grassland remain lowland meadow where a number of species typical of this habitat can be seen such as Marsh Marigold <i>Caltha palustris</i> , Sneezewort <i>Achillea ptarmica</i> , Common Knapweed <i>Centaurea nigra</i> , Ragged Robin <i>Lychnis flos-cuculi</i> and Brown Sedge <i>Carex disticha</i> . There are 15 plant species typical of lowland meadow and 16 species typical of fen habitats.	0.4 km east of Clifton Hampden Bypass. The LWS includes wetland directly connected to the Thames and is downstream from the Scheme. No designated features that are also WFD quality elements. The Thames river crossing is a low risk to WFD elements.	Screen Out

Non-statutory Site Name	Reason(s) for Designation	Distance (km) and direction to closest point of Scheme; and relationship to the Scheme (approx.)	WFD Screening
Kelart's Field potential LWS (pLWS)	A reasonably diverse large semi-improved grassland area with some elements of lowland meadow habitat. Dominant grasses consist of Red Fescue <i>Festuca rubra</i> , Yorkshire Fog, Creeping Bent <i>Agrostis stolonifera</i> , False Oat-grass <i>Arrhenatherum elatius</i> , Perennial Rye-grass <i>Lolium perenne</i> , Meadow Foxtail, Sweet Vernal-grass and Crested dogs-tail.	0.7 km west of Didcot to Culham River Crossing. No ecological connections between the pLWS and the Scheme.	Screen Out
Radley Gravel Pits LWS	Variety of terrestrial habitats with large areas of open ground, grassland, scrub, sedge bed and reedbed, and small areas of fen and wet woodland. The open ground includes freely drained and waterlogged areas, with a wide variety of ruderals species both native and introduced. The grassland is recent and lies over former arable or gravel areas. It has species which prefer neutral to calcareous and un-grazed conditions. The scrub is mostly over landfill and is composed of Hawthorn <i>Crataegus monogyna</i> and Bramble <i>Rubus fruticosus</i> with introduced species such as Buddleia <i>Buddleja davidii</i> . The sedge beds are species rich and include many young Willow <i>Salix</i> .	1.2 km north of Didcot to Culham River Crossing. No ecological connections between the LWS and the Scheme.	Screen Out
Thames Radley to Abingdon CTA	This area includes gravel pits with one site rich in aquatic plants. There are also small areas of wet woodland, areas of fen which is important for Lodden Lily <i>Leucojum aestivum</i> and important nesting Lapwing <i>Vanellus</i> habitat.	1.2 km north of Didcot to Culham River Crossing. No ecological connections between the CTA and the Scheme.	Screen Out
Radley Gravel Pits Extension South LWS	Forms part of Radley Gravel Pits LWS.	1.3 km north of Didcot to Culham River Crossing. No ecological connections between the LWS and the Scheme.	Screen Out
Hayward's Eyot LWS	Low-lying site adjacent to the River Thames in the village of Long Wittenham. Formerly an island, it comprises channels either side of the site, with springs and ponds to the south. A now extinct major channel of the river to the south created the steep bank which now delimits the site on this side. Summer snowflake is found in several locations across the site. This is a Red Data Book species with a very restricted distribution in the UK; this site may carry between five and ten thousand plants, which makes it one of the larger populations. It is also unusual on this site in growing in the open amongst reed and reed sweet grass rather than under willow carr.	1.4 km south-east of Clifton Hampden Bypass. This LWS is adjacent to the River Thames and downstream from the Scheme and comprises relict hydromorphological features of the River Thames. However, the Thames river crossing is a low risk to WFD elements.	Screen Out
Nuneham Arboretum LWS	This site lies on a plateau and was previously a park and contains areas of unimproved grassland, ponds, woodland and parkland.	1.8 km north-east of Clifton Hampden Bypass. No ecological connections between the LWS and the Scheme.	Screen Out

5.6 Scheme Element WFD Screening

- 5.6.1 An inventory of drainage structures and watercourse crossing structures has been compiled for the Scheme. Each structure has been reviewed for potential impacts on WFD objectives, as summarised in Table 5.5.
- 5.6.2 The majority of proposed structures are for drainage ditches that are typically dry. Other proposed structures are for flood alleviation, which will also be typically dry. Neither type of structure will impact perennial water habitats and can therefore be screened out of the WFD assessment.
- 5.6.3 The DGT HIF 1 Scheme Drainage Strategy (AECOM, 2021) (Ref 4) has been developed to manage surface water runoff in accordance with current highway design standards. The strategy is that drainage will be treated by attenuation features such as balancing ponds and swales and discharged to existing ditches at greenfield rates. Watercourses and other attenuation features will also be landscaped to provide optimal water treatment.
- 5.6.4 At this preliminary design stage, confirmed details of pond and swale sizing, outfall positions, and headwall designs for receiving watercourses are not available. The assessments in ES Chapter 14: Road Drainage and the Water Environment, including HEWRAT, identifies that preliminary designs pass water quality treatment standards. It is therefore assessed that there will be no runoff impacts from new highways on WFD objectives.
- 5.6.5 A shortlist of structures that could pose risks to WFD objectives is summarised in Table 5.6.
- 5.6.6 To summarise WFD screening, Table 5-6 and Table 5-7 demonstrate that most of the drainage structures can be screened out of further WFD assessment.
- 5.6.7 The elements of the Scheme that have been screened in (Table 5-7) comprise new culverts for Scheme crossings of existing watercourses. Impact risks and mitigation are summarised in the Scoping Assessment.

Table 5-6: WFD Screening of Drainage Structures

Scheme Area	WFD Water Body	Watercourse - Aquatic baseline	Structure name	Culvert Type	Centroid Grid Reference	Dimensions (Width x Height) (m) (approx.)	Length (m) (approx.)	Screen In or Out	Screening Justification
A4130	Moor Ditch and Ladygrove Ditch	Unnamed drainage ditch	A4130_1	Box Culvert	450549,191225	2 x 2	20.5	Screen In	Potential aquatic habitat, although baseline ecology surveys identified habitat of limited value.
A4130	Moor Ditch and Ladygrove Ditch	n/a	A4130_2	Box Culvert (double pipe)	450508,191125	2 x 2 x 2	78.9	Screen Out	Flood relief culvert parallel to A4130_5 that will typically be dry and will not support aquatic habitat.
A4130	Moor Ditch and Ladygrove Ditch	n/a	A4130_3	Box Culvert (double pipe)	450275,191099	2 x 2 x 1	25.2	Screen Out	Flood relief culvert parallel to A4130_4 that will typically be dry and will not support aquatic habitat.
A4130	Moor Ditch and Ladygrove Ditch	Meadow Brook	A4130_4	Box Culvert	450258,191130	1.5 x 1.5	27.2	Screen In	Aquatic habitat, although baseline ecology surveys identified habitat of limited value.
A4130	Moor Ditch and Ladygrove Ditch	Meadow Brook	A4130_5	Box Culvert	450520,191143	1.5 x 1.35	76.1	Screen In	Aquatic habitat, although baseline ecology surveys identified habitat of limited value.
A4130	Moor Ditch and Ladygrove Ditch	Meadow Brook	A4130_5-Banks	Bank raising adjacent to culverts	450175,191120	0.1 to 0.2 high bank level adjustments	116.0	Screen out	Flood risks assessment identified that only 0.1 m to 0.2 m adjustments to existing bank levels are required for flood management. Not considered significant to WFD and aquatic habitat.
A4130	Moor Ditch and Ladygrove Ditch	Ditch Adjacent to Backhill Lane	A4130_6	Pipe Culvert	448898,191338	0.3 diameter	21.8	Screen out	Ephemeral ditch surveyed as dry in autumn baseline ecology surveys identified habitat of limited value.
A4130	Moor Ditch and Ladygrove Ditch	Ditch Adjacent to Backhill Lane	A4130_7	Pipe Culvert	448904,191486	0.6 diameter	5.7	Screen out	Baseline ecology survey for A4130_6, 20 m away, identified an ephemeral ditch, dry in autumn, with habitat of limited value.

Scheme Area	WFD Water Body	Watercourse - Aquatic baseline	Structure name	Culvert Type	Centroid Grid Reference	Dimensions (Width x Height) (m) (approx.)	Length (m) (approx.)	Screen In or Out	Screening Justification
A4130	Moor Ditch and Ladygrove Ditch	Stert brook	A4130_8	Box Culvert	449492,191423	1.2 x 1.2	23.7	Screen In	Aquatic habitat. WFD data for this main watercourse of the water body suggested that macrophytes are Good status, but only 1 scoring species was found in local surveys (<i>Apium nodiflorum</i>). Invertebrates scored as moderate by CCI, PSI score indicated heavy sedimentation in spring, and LIFE shows high sensitivity to flow in autumn.
A4130	Moor Ditch and Ladygrove Ditch	Cow Brook	A4130_9	Box Culvert	450036,191423	1.2 x 1	24.4	Screen Out	Ephemeral ditch surveyed as dry in spring and autumn.
DSB	Moor Ditch and Ladygrove Ditch	Moor Ditch	BWB Culvert	Pipe Culvert	450977,191465	1.8m Diameter	90.6	Screen Out	Existing culvert beneath the former Didcot A Power Station; this location central to >600 m culvert length. Requirement is to reinforce the existing culvert to construct the proposed highway above, not feasible to daylight this location.
DSB	Moor Ditch and Ladygrove Ditch	Moor Ditch	DSB Moor Ditch Culvert	Pipe Culvert	451365,191542	1.5 x 2.4	40.0 proposed 74.4 existing	Screen In	Aquatic habitat, although baseline ecology surveys identified habitat of limited value.
DSB	Moor Ditch and Ladygrove Ditch	Unnamed drainage ditch	DSB Dry Ditch Culvert	Pipe Culvert	451626,191652	600 mm Diameter	50.8	Screen Out	Dry ditch
River Crossing	Thames (Evenlode to Thame)	River Thames	River Thames Crossing	Clear span bridge	451969,194470	17.9 x 4.7 (nominal)	65 m main span across 40 m wide river	Screen Out	Low risk activity. Aquatic and high value habitat. Proposed crossing is clear span bridge with deck level high above water.
River Crossing	Thames (Evenlode to Thame)	River Thames Floodplain	River Thames Crossing	Culvert / viaduct	451969,194470	17.9 x 4.7 (nominal)	155 m river bridge 336m approach viaduct	Screen In	Restored floodplain habitats in former gravel pits. Aquatic and high value habitat. Proposed crossing is viaduct on piers, with no piers in the Thames channel or on bank tops, and a length of culvert at the tie in with the ground level.

Scheme Area	WFD Water Body	Watercourse - Aquatic baseline	Structure name	Culvert Type	Centroid Grid Reference	Dimensions (Width x Height) (m) (approx.)	Length (m) (approx.)	Screen In or Out	Screening Justification
CHB	Moor Ditch and Ladygrove Ditch	Unnamed drainage ditch	Station Access Foot Bridge	Box culvert	453087,195214	2.5 x 1.5	11.5	Screen Out	Dry ditch
CHB	Moor Ditch and Ladygrove Ditch	Unnamed drainage ditch	West Footpath culvert	Pipe culvert	453140,195228	NA x 0.8	11.0	Screen Out	Dry ditch
CHB	Moor Ditch and Ladygrove Ditch	Unnamed drainage ditch	Entrance 1 Culvert	Box culvert	453663,195294	1.8 x 1.2	23.0	Screen Out	Dry ditch
CHB	Moor Ditch and Ladygrove Ditch	Unnamed drainage ditch	A415 Connection Culvert	Box culvert	453608,195362	1.8 x 1.2	24.0	Screen Out	Dry ditch
CHB	Moor Ditch and Ladygrove Ditch	Unnamed drainage ditch	A415 West Overland Culvert	Box culvert	453755,195569	1.8 x 1.8	20.0	Screen Out	Dry ditch
CHB	Moor Ditch and Ladygrove Ditch	Unnamed drainage ditch	CHB Pond 3 Culvert	Box culvert	453796,195577	1.8 x 1.8	6.4	Screen Out	Dry ditch
CHB	Moor Ditch and Ladygrove Ditch	Unnamed drainage ditch	A415 East Watercourse 4 Culvert (crossing)	Box culvert	454734,196212	3.5 x 1.8	35.0	Screen Out	Dry ditch
CHB	Moor Ditch and Ladygrove Ditch	Unnamed drainage ditch	Watercourse 3 track foot bridge	timber foot bridge	454576,196158	2.5 x 1.0	6.3	Screen Out	Ephemeral ditch surveyed as dry in Autumn. High CCI score, but no notable species identified. Clear span bridge and low risk activity.
CHB	Moor Ditch and Ladygrove Ditch	Unnamed drainage ditch	Watercourse 4 track foot bridge	timber foot bridge	454717,196237	2.5 x 1.2	6.4	Screen Out	Dry ditch/ clear span bridge and low risk activity
CHB	Moor Ditch and Ladygrove Ditch	Unnamed drainage ditch	Culham Treatment works entrance Culvert	Box culvert	453886,195691	1.8 x 1.5	17.0	Screen Out	Dry ditch
CHB	Moor Ditch and Ladygrove Ditch	Unnamed drainage ditch	A415 CSC Culvert	Box culvert	454003,195747	1.2x1.2	19.0	Screen Out	Dry ditch

Scheme Area	WFD Water Body	Watercourse - Aquatic baseline	Structure name	Culvert Type	Centroid Grid Reference	Dimensions (Width x Height) (m) (approx.)	Length (m) (approx.)	Screen In or Out	Screening Justification
CHB	Moor Ditch and Ladygrove Ditch	Unnamed drainage ditch	CSC Secondary Access Culvert	Box culvert	454026,195836	1.2x1.2	19.0	Screen Out	Dry ditch
CHB	Moor Ditch and Ladygrove Ditch	Unnamed drainage ditch	CSC Foot Path Culvert	Box culvert	454153,195847	1.0x1.0	9.0	Screen Out	Dry ditch
CHB	Moor Ditch and Ladygrove Ditch	Unnamed drainage ditch	Thame Lane Culvert	Box culvert	454277,195899	0.8x0.8	10.8	Screen Out	Dry ditch
CHB	Moor Ditch and Ladygrove Ditch	Unnamed drainage ditch	Farm Access culvert	Box culvert	454375,195864	0.75x0.75	7.5	Screen Out	Dry ditch
CHB	Moor Ditch and Ladygrove Ditch	Unnamed drainage ditch	B4015 Culvert	Box culvert	454795,196138	1.5x1.5	23.5	Screen Out	Dry ditch
CHB	Moor Ditch and Ladygrove Ditch	Unnamed drainage ditch	B4015 Foot Bridge	timber foot bridge	454779,196106	2.5x0.8	4.8	Screen Out	Dry ditch
CHB	Moor Ditch and Ladygrove Ditch	Unnamed drainage ditch	A415 South Foot Bridge	timber foot bridge	454250,195848	2.5x1.0	16.7	Screen Out	Dry ditch/ clear span bridge and low risk activity.
CHB	Moor Ditch and Ladygrove Ditch	Unnamed drainage ditch	CHB Flood relief culvert (new)	Pipe culvert (double pipe)		NA x 0.6	330.0	Screen Out	Flood relief culvert, not perennial aquatic habitat.

Table 5-7: Shortlist of Drainage Structures Screened In for WFD Assessment

Scheme Area	WFD Water Body	Watercourse - Aquatic baseline	Structure name	Culvert Type	Centroid Grid Reference	Dimensions (Width x Height) (m) (approx.)	Length (m) (approx.)	Screen In or Out	Screening Justification
A4130	Moor Ditch and Ladygrove Ditch	Unnamed drainage ditch	A4130_1	Box Culvert	450549,191225	2 x 2	20.5	Screen In	Potential aquatic habitat, although baseline ecology surveys identified habitat of limited value.
		Meadow Brook	A4130_4	Box Culvert	450258,191130	1.5 x 1.5	27.2	Screen In	Aquatic habitat, although baseline ecology surveys identified habitat of limited value.
			A4130_5	Box Culvert	450520,191143	1.5 x 1.35	76.1	Screen In	Aquatic habitat, although baseline ecology surveys identified habitat of limited value.
		Stert Brook	A4130_8	Box Culvert	449492,191423	1.2 x 1.2	23.7	Screen In	Aquatic habitat. WFD data for this main watercourse of the water body suggested that macrophytes are Good status, but only 1 scoring species was found in local surveys (<i>Apium nodiflorum</i>). Invertebrates scored as moderate by CCI, PSI score indicated heavy sedimentation in spring, and LIFE shows high sensitivity to flow in autumn.
DSB		Moor Ditch	DSB Moor Ditch Culvert	Pipe Culvert	451365,191542	1.5 x 2.4	40.0 proposed 74.4 existing	Screen In	Aquatic habitat, although baseline ecology surveys identified habitat of limited value.

6. Scoping Assessment

6.1 Overview

- 6.1.1 The WFD scoping stage defines the level of detail required for further WFD assessment for the water body and Scheme elements screened into the assessment..
- 6.1.2 The screening assessment in Section 5 identified WFD risks associated with the Scheme as related to new culverts on watercourse aquatic habitats, which are all within the Moor Ditch and Lady Grove Ditch waterbody.
- 6.1.3 The clear span crossing of the River Thames (Evenlode to Thame) WFD Water Body is considered a low risk activity that has been screened out of the scoping assessment.
- 6.1.4 The Scheme does not overlie a WFD groundwater body, but risks to local groundwater are included in the scoping assessment, since local groundwater could connect different surface watercourses.
- 6.1.5 The requirement for new culvert crossings by the Scheme means that there will be an unavoidable loss of open channel habitat within the Moor Ditch and Lady Grove Ditch waterbody. The existing approximate 74.4 m Moor Ditch culvert will be replaced with an approximate 40 m culvert to offset some of this loss, but in total there will be approximately 113.1 m of new culverts and associated loss of open watercourse habitat (refer to Table 6.1). Compared with the approximate 8.398 km water body length (refer to Table 4.1), this is a net loss of approximate 1.3% of the water body open watercourse habitat.
- 6.1.6 It may be necessary to construct outfall headwalls along watercourse banks, which will result in addition lengths of watercourse impact. Design details are not available at this stage, so lengths have not yet been assessed. The current Scheme design intent is to construct headwalls in line with channel profiles to prevent any protrusion into the watercourse and impacts in the channels, as well as along the banks. Potentially, if space allows, 'grey' outfall headwalls could be set back from the watercourses, with 'green' connecting ditches that will reduce impacts on the watercourses.
- 6.1.7 Space along Meadow Brook has been earmarked in the Scheme boundary (within the junction of the A4130 widening and the Science Bridge – refer to Annex A) for watercourse enhancements to mitigate culvert and any headwall impacts. It is identified that approximately 150 m of watercourse enhancements will be required to mitigate the Scheme impacts on open channel habitats (due to loss of open channels and the impacts of headwalls). The design of these features to mitigate this impact will be undertaken during detailed design of the Scheme.

6.1.8 The existing Meadow Brook is highly modified in this location by historic straightening, and is a low quality, uniform and trapezoidal channel. Enhancements of this degraded habitat will therefore be considered to adequately mitigate the loss of open watercourse elsewhere in the water body. Recommendations for the nature of enhancement designs are provided in Section 7: Summary of Mitigation Measures.

Table 6-1: Cumulative impact of new culverts on open watercourses in the Moor Ditch and Lady Grove Ditch waterbody

Scheme Area	WFD Water Body	Watercourse local name	Structure name	Culvert Type	Dimensions (Width x Height) (m) (approx.)	Length (m) (approx.)
A4130	Moor Ditch and Ladygrove Ditch	Unnamed drainage ditch	A4130_1	Box Culvert	2 x 2	20.5
		Meadow Brook	A4130_4	Box Culvert	1.5 x 1.5	27.2
			A4130_5	Box Culvert	1.5 x 1.35	76.1
		Stert brook	A4130_8	Box Culvert	1.2 x 1.2	23.7
DSB		Moor Ditch	DSB Moor Ditch Culvert	Pipe Culvert	1.5 x 2.4	40.0 proposed
						74.4 existing
Culvert cumulative impact net length for the water body						113.1 m of new culverts
Potential headwall impact lengths						Unknown
Contingency in the WFD assessment for design uncertainty, and for the Scheme objective for 10% biodiversity net gain						>30 m
Recommended minimum length of watercourse enhancements for Scheme mitigation designs and WFD compliance						150 m

6.2 Biological Risks and Mitigation: Construction

Impact	Mitigation
<ul style="list-style-type: none"> Construction of the Scheme will require works in and close to water bodies. This means that there is potential for negative impacts on water quality and biological elements, for example through spillage of hazardous chemicals (such as fuel, grout etc) during construction. Construction works could mobilise fine sediments which may enter water bodies and have negative impacts on bed habitats. The potential for in-channel works could mean that flow will need to be diverted while construction works are undertaken. This will have a negative impact on all biological elements within the affected watercourses. 	<ul style="list-style-type: none"> The Principal Contractor (PC) will mitigate these risks using an approved Construction Environmental Management Plan (CEMP) and appropriate site management techniques (as based upon the Outline Environmental Management Plan (OEMP) as included in the ES – refer to ES Appendix 4.2). The pollution prevention measures will be based on Good Practice Guidance (GPP). This includes GPP published on the NetRegs website⁵. While these are not regulatory guidance in England, it remains a useful resource for best practice: <ul style="list-style-type: none"> GPP 1: Understanding your environmental responsibilities – good environmental practices; GPP 2: Above ground oil storage; GPP 3: Use and design of oil separators in surface water drainage systems; GPP 4: Treatment and disposal of wastewater where there is no connection to the public foul sewer; GPP 5: Works and maintenance in or near water; GPP 8: Safe storage and disposal of used oils; GPP 13: Vehicle washing and cleaning; GPP 19: Vehicles: Service and Repair; GPP 20: Dewatering underground ducts and chambers; GPP 21: Pollution Incident Response Plans; GPP22: Dealing with spills; and GPP26: Safe storage – drums and intermediate bulk containers. Additional good practice guidance for mitigation to protect the water environment can be found in key CIRIA documents and British Standards Institute documents, as listed in ES Chapter 14 Road Drainage and the Water Environment. The measures outlined below, which will be included in the CEMP and a supporting Water Management Plan (WMP), will be required for the management of fine sediments in surface water runoff as a result of the construction activities: <ul style="list-style-type: none"> Reasonably practicable measures will be taken to prevent the deposition of fine sediment or other material in, and the pollution by sediment of, any existing waterbody, arising from construction activities. The measures will accord with the principles set out in industry guidelines including the CIRIA report 'C532: Control of water pollution from construction sites'⁶. Measures may include use and maintenance of temporary lagoons, tanks, seeding / covering of earth stockpiles, earth bunds, straw bales and sandbag walls, proprietary measures (e.g. lamella clarifiers or contained chemical treatment) and fabric silt fences or silt screens as well as consideration of the type of plant used. A temporary drainage system will be developed to prevent runoff contaminated with fine particulates from entering surface water drains without treatment. This will include identifying all land drains and water bodies on the Site and ensuring that they are adequately protected using drain covers, sandbags, earth bunds, geotextile

⁵ <https://www.netregs.org.uk/environmental-topics/guidance-for-pollution-prevention-gpp-documents/guidance-for-pollution-prevention-gpps-full-list/> Accessed July 2022

⁶ CIRIA (2001) C532: Control of water pollution from construction sites – Guidance for consultants and contractors.

Impact	Mitigation
	<p>silt fences, straw bales, or proprietary treatment (e.g. lamella clarifiers). Discharge to such water bodies (directly or indirectly) will only be made with the permission of the EA and with the necessary treatment measures implemented.</p> <ul style="list-style-type: none"> – Where possible, earthworks will be undertaken during the drier months of the year and will avoid periods of wet weather (if possible) to minimise the risk of generating runoff contaminated with fine particulates. However, it is likely that some working during wet weather periods will be unavoidable, in which case mitigation measures will be implemented to control fine sediment laden runoff. – To protect waterbodies from fine sediment runoff, topsoil/subsoil will be stored a minimum of 20 m from any water body on flat lying land (and further if the ground is sloping, subject to on site risk assessment on observational monitoring) and not within the fluvial floodplain. Where this is not possible, and it is to be stockpiled for longer than a two-week period, the material will either be covered with geotextile mats, seeded to promote vegetation growth. In all situations, runoff from the stockpile will be prevented from draining to a watercourse without prior treatment. If located where there is a risk of flooding, additional measures will be provided to reduce the risk of erosion (e.g. by protecting the base using spaced out concrete blocks, pegged in geotextile sheets, etc.). – Appropriately sized runoff storage areas for the settlement of excessive fine particulates in runoff will be provided. It is likely that treated water will then be pumped under a temporary Water Activity Permit from the EA or to a water treatment works as agreed with the sewerage undertaker. – Mud deposits will be controlled at entry and exit points to the Site using wheel washing facilities and / or road sweepers operating during earthworks activities or other times as considered necessary. – Equipment and plant are to be washed out and cleaned in designated areas within the Site compound where runoff can be isolated for treatment before discharge to surface water drainage under appropriate consent and / or agreement with Environment Agency, or otherwise removed from site for appropriate disposal at a licensed waste facility. – Debris and other material will be prevented from entering surface water drainage, through maintenance of a clean and tidy site, provision of clearly labelled waste receptacles, grid covers and the presence of site security fencing. – The WMP will include details of pre, during and post-construction water quality monitoring. This will be based on a combination of visual observations, frequent in situ testing using water quality probes, and periodic sampling for laboratory analysis. <p>Proposed measures for management of Spillage Risk:</p> <ul style="list-style-type: none"> – The measures outlined below will be implemented to manage the risk of accidental spillages on site and potential conveyance to nearby waterbodies via surface runoff or land drains. The measures relating to the control of spillages and leaks will be included in the WMP and OEMP and adopted during the construction works: – Fuel will be stored and used in accordance with the Control of Substances Hazardous to Health Regulations 2002, and the Control of Pollution (Oil Storage) (England) Regulations 2001. Particular care will be taken with the delivery and use of concrete and cement as it is highly corrosive and alkaline. – Fuel and other potentially polluting chemicals will either be in self bunded leak proof containers or stored in a secure impermeable and bunded area (minimum capacity of 110% of the capacity of the containers). – Any plant, machinery or vehicles will be regularly inspected and maintained to ensure they are in good working order and clean for use in a sensitive environment. This maintenance is to take place off site if possible or only

Impact	Mitigation
	<p>at designated areas within the Site compound. Only construction equipment and vehicles free of all oil/fuel leaks will be permitted on site. Drip trays will be placed below static mechanical plant.</p> <ul style="list-style-type: none"> – All washing down of vehicles and equipment will take place in designated areas and wash water will be prevented from passing untreated into watercourses. – All refuelling, oiling and greasing will take place above drip trays or on an impermeable surface which provides protection to underground strata and watercourses, and away from drains as far as reasonably practicable. Vehicles will not be left unattended during refuelling. – As far as reasonably practicable, only biodegradable hydraulic oils will be used in equipment working in or over watercourses. – All fixed plant used on the Site will be self-bunded. – Mobile plant is to be in good working order, kept clean and fitted with plant 'nappies' at all times. – A Pollution Prevention Plan will be prepared and included alongside the CEMP. Spill kits and oil absorbent material will be carried by mobile plant and located at high risk locations across the Site and regularly topped up. All construction workers will receive spill response training and toolbox talks. – The Site will be secure to prevent any vandalism that could lead to a pollution incident. – Construction waste / debris are to be prevented from entering any surface water drainage or water body. – Surface water drains on roads or within the construction compound will be identified and, where there is a risk that fine particulates or spillages could enter them, the drains will be protected (e.g. using covers or sandbags). – Suitable facilities for concrete wash water (e.g. geotextile wrapped sealed skip, container or earth bunded area) will be adequately contained, prevented from entering any drain, and removed from the Site for appropriate disposal at a suitably permitted waste facility. – Water quality monitoring of potentially impacted watercourses will be undertaken to ensure that pollution events can be detected against baseline conditions and can be dealt with effectively. <ul style="list-style-type: none"> • In addition, any site welfare facilities will be appropriately managed, and all foul waste disposed of by a licensed contractor to a suitably permitted facility. • Works should be timed to avoid fish migration and spawning seasons as far as possible to reduce these impacts. There will be temporary fragmentation of watercourses including Moor Ditch during construction, and this watercourse has been shown to support bullhead. Mitigation including fish rescue and translocation may be required during construction of culverts to relocate fish away from the works areas. • Standard practice bio-security measures will be required to ensure that no invasive species are spread around site or translocated elsewhere. Measures will need to include checks of plant/ vehicles and footwear to ensure clean and clear of potential contaminants with best practice implemented as necessary

6.3 Biological Risks and Mitigation: Operation

Impact	Mitigation
<ul style="list-style-type: none"> There will be an increased impermeable area as a result of the Scheme which could result in increased road runoff laden with pollutants which could enter water bodies and negatively impact water quality, and in turn, biological elements. Additional permanent shading from new culverts will have adverse impacts locally on biological elements. However, baseline surveys of the watercourses comprising the Moor Ditch and Ladygrove Ditch waterbody identified generally highly modified watercourses within the study area, with low ecological value. The new culverts are generally adjacent to existing culverts, so are unlikely to cause severe habitat fragmentation compared to the existing baseline. Impacts will be localised and are unlikely to have a significant impact at the water body scale. New headwalls may be required which will have additional physical impacts on watercourse bank habitats. 	<ul style="list-style-type: none"> The Drainage Strategy Report (AECOM, 2021) details the drainage design which has been developed in accordance with DMRB, OCC's Local Standards and Guidance for Surface Water Drainage on Major Development in Oxfordshire, and the requirements of the NPPF, alongside advice from environmental practitioners responsible for undertaking water related assessments. The drainage design aims to minimise effects on water quality by using natural storage, treatment and discharge solutions to manage surface water drainage during the operational phases of the Scheme. The preliminary drainage design is based on the following key assumptions: <ul style="list-style-type: none"> Attenuation features for highway drainage will be required to store the 1 in 100 year storm event with a 20% allowance for climate change (and checked that the flood water does not endanger property or life when a 40% climate change allowance is made). Flood Estimation Handbook (FEH; Ref 14.82) rainfall data has been utilised for the hydraulic design of the drainage systems. The design follows criteria described in the DMRB and OCC Local Standards and Guidance, and ensures no surcharging of the drainage system for the 1 in 1 year return period, and no flooding of the surface of the site for 1 in 30 year return period and flooding only in safe areas for the 1 in 100 year return period. Surface water runoff from additional impermeable areas will be attenuated and the discharge rate will be restricted to a Qbar flow rate (the mean annual flood flow rate from a rural catchment), with a suitable flow control device to ensure runoff flows and volumes are not more than the existing condition. These will be sized to ensure no flooding in a 1 in 100-year storm event with a 20% allowance for climate change when the discharge is restricted to a Qbar flow rate. SuDS in the form of swales, dry ponds, wet ponds, ditches and filter drains have been deployed within the various drainage catchments for the Scheme, to treat and attenuate the surface water runoff in accordance with The SuDS Manual which is referred to in DMRB CD532 . SuDS also offer opportunities for ecological habitat creation and landscaping. Road runoff will be discharged to surface watercourses except for four outfalls on the Didcot to Culham River Crossing section, where water will be discharged to ground via an infiltration basin. One outfall from the Clifton Hampden Bypass will discharge to a CSC surface water sewer. The proposed connection to the sewer has been attenuated to 5 l/s. The treatment train for every outfall required by the Scheme is presented in Appendix 14.3 Assessment of Routine Road Runoff and Accidental Spillages. Maintenance requirements have been considered for all surface water attenuation features (ponds, swales, ditches) by providing access to features mainly from local roads SuDS Maintenance and Management Plans will be prepared for each section of the Scheme during the detailed design stage by PC on behalf of OCC. These documents will set out the principles for the long-term management and maintenance of the proposed SuDS and outline who will be responsible for their maintenance and management. These documents will ensure that the company appointed by OCC to manage and maintain the SuDS is provided with a robust inspection and maintenance programme. Optimum operation of the

Impact	Mitigation
	<p>surface water drainage network is important throughout the lifetime of the Scheme, to ensure no future deterioration of water quality or increase in discharge rates. Maintenance requirements are outlined in accordance with recommendations in CIRIA C753 The SuDS Manual.</p> <ul style="list-style-type: none"> • The specific SuDS treatments ('the SuDS treatment train') that have been built into the design of each drainage catchment for the Scheme are outlined in Appendix 14.3 Assessment of Routine Road Runoff and Accidental Spillage Risk (HEWRAT). The suitability of each of these treatment trains has been assessed using the National Highways (Highways England) Water Risk Assessment Tool (HEWRAT) within Appendix 14.3, and in every case sufficient mitigation has been provided to ensure no adverse impact on the receiving water environment in terms of water pollution (surface water or groundwater). The outfall locations across the Scheme are shown in Figure 14.9 and discussed further within ES Chapter 14 Road Drainage and the Water Environment. An update to the HEWRAT assessment would be undertaken at the detailed design stage to account for any changes made to the proposed drainage treatments and to ensure that all receiving water features remain adequately protected. • Culverts have been designed appropriately to maintain connectivity along watercourses for aquatic species and riparian mammals. Culverts will include mammal ledges of 500 mm width to facilitate passage of riparian mammals such as otters. Culvert inverts will be set 150 mm below bed level to allow continuity of bed substrate habitats, which will maintain longitudinal connectivity for fish and other aquatic fauna. • The existing approximate 74.4 m Moor Ditch culvert will be replaced with an approximate 40 m culvert, a reduction of local culvert length and corresponding increase of open channel habitat of approximately 34.4 m. • Potentially headwalls could be set back from watercourses with green soft ditch connections to the aquatic habitats. • Watercourse enhancements are required for WFD compliance and at least 150 m of watercourse improvements are recommended.

6.4 Potential Physicochemical Impacts

Construction Impacts

Impact	Mitigation
<ul style="list-style-type: none"> There are likely to be localised temporary impacts, particularly in terms of runoff containing possible contaminants associated with construction (e.g. cement/fuel). Construction works could mobilise fine sediments which may enter water bodies and have negative impacts on bed habitats. Culvert crossings will require in-channel works. This means that there is potential for negative impacts on water quality and biological elements, for example through spillage of hazardous chemicals (such as fuel, grout etc.) during construction. 	<ul style="list-style-type: none"> The contractor will mitigate these risks using an approved CEMP and WMP and appropriate site management and pollution prevention techniques, as outlined in full in Section 6.3 and in the OEMP (Appendix 4.2) The CEMP will include measures to reduce the risk of chemical spillages, and should include the use of bunded fuel tanks, spill kits, plant nappies on static plant, and the implementation of an Emergency Response Plan, and the refuelling of plant away from any water bodies.

Operational Impacts

Impact	Mitigation
<ul style="list-style-type: none"> There will be an increased impermeable area as a result of the Scheme, which could result in increased road runoff laden with pollutants which could enter water bodies and negatively impact water quality. 	<ul style="list-style-type: none"> The sustainable drainage design will mitigate runoff quantity from new areas of highways runoff with balancing ponds and swales. Pollution treatment trains will be implemented to control pollutants before attenuated drainage is discharged to water bodies. Refer to Section 6.2 above for further detail, as well as Appendix 14.3 Assessment of Routine Road Runoff and Accidental Spillages (HEWRAT) and Chapter 14 Road Drainage and the Water Environment.

6.5 Potential Hydro-morphological Impacts

Construction Impacts

Impact	Mitigation
<ul style="list-style-type: none"> Construction works could mobilise fine sediments which may enter water bodies and have negative impacts on bed habitats. The potential for in-channel works could require the diversion of flows which could have significant impacts on flow patterns and sediment transport. 	<ul style="list-style-type: none"> The PC will mitigate these risks using an approved CEMP, WMP and appropriate site management techniques as outlined above. The CEMP will include measures to reduce the risk of chemical spillages, and should include the use of bunded fuel tanks, spill kits, plant nappies on static plant, and the implementation of an Emergency Response Plan, and the refuelling of plant away from any water bodies. Construction impacts will be temporary and if methods of best practice are employed, this will lead to no permanent negative impacts.

Operational Impacts

Impact	Mitigation
<ul style="list-style-type: none"> New highways surfaces will result in increased particulate runoff. New culverts will permanently reduce the length of open watercourse within the water body. New headwalls may be required which will have additional physical impacts on watercourse bank habitats. 	<ul style="list-style-type: none"> The Scheme sustainable drainage design will mitigate runoff quantity from new areas of highways runoff with balancing ponds and swales. Pollution treatment trains will be implemented to control pollutants before attenuated drainage is discharged to water bodies. Refer to Section 6.2 above for further detail, as well as Appendix 14.3 Assessment of Routine Road Runoff and Accidental Spillages (HEWRAT) and Chapter 14 Road Drainage and the Water Environment. The existing approximate 74.4 m Moor Ditch culvert will be replaced with an approximate 40 m culvert: a reduction of local culvert length and corresponding increase of open channel habitat of approximate 34.4 m. Potentially headwalls could be set back from watercourses with green soft ditch connections to the aquatic habitats. Length-for-length watercourse enhancement is required to offset the impacts of new culverts. Watercourse enhancements are required for WFD compliance and at least 150 m of watercourse improvements are recommended.

6.6 Potential Groundwater Impacts

Construction Impacts

Impact	Mitigation
<ul style="list-style-type: none"> Contamination arising from spillages associated with the use and storage of construction chemicals, such as fuels could occur on groundwater bodies during construction works. Construction activities may also open and modify potential pollutant linkages, including the disturbance of sediments, which may have adverse impacts on groundwater. Excavations, piling, and other sub-surface works could encounter groundwater and increase risk pathways between the surface and groundwater bodies. The Scheme does not overlie a WFD groundwater body, and local groundwater is Secondary aquifer. There is unlikely to be significant connectivity to the WFD water body. 	<ul style="list-style-type: none"> The PC will mitigate these risks using an approved CEMP, WMP and appropriate site management techniques. The CEMP will include measures to manage the formation of excessive sediment in runoff and to reduce the risk of chemical spillages. Construction impacts will be temporary and if methods of best practice are implemented this will lead to no permanent negative impacts. Additional ground investigations and suitable construction mitigation planning including groundwater management and pollution prevention measures will be required at the appropriate design stage.

Operational Impacts

Impact	Mitigation
<ul style="list-style-type: none"> Increased highway runoff containing pollutants associated with vehicles could enter groundwater bodies and negatively impact groundwater quality. The Scheme does not overlie a WFD groundwater body, and local groundwater is Secondary aquifer. There is unlikely to be significant connectivity to the WFD water body. 	<ul style="list-style-type: none"> The sustainable drainage design will mitigate runoff quantity from new areas of highways runoff with balancing ponds and swales. Pollution treatment trains will be implemented to control pollutants before attenuated drainage is discharged to water bodies. Refer to Section 6.5 above for further detail, as well as Appendix 14.3 Assessment of Routine Road Runoff and Accidental Spillages (HEWRAT) and Chapter 14 Road Drainage and the Water Environment. In addition, the new drainage system proposed for the Scheme has been designed to prevent and/or minimise the risk of groundwater contamination from highway runoff. Where groundwater levels are high, SuDS features will be lined in such a way that contamination of groundwater is prevented whilst ensuring the liner remains in place. Should the levels be prohibitively high, an alternative surface water connection will be made.

7. Summary of Mitigation Measures

7.1.1 Mitigation measures have been incorporated into the Scheme design to minimise potential adverse impacts, particularly during the construction phase. The Scheme should also be viewed as an opportunity to make improvements to the local environment where possible. Watercourse enhancements to compensate for operational impacts on watercourses (especially new culverts), should be designed to equivalent or greater lengths along the watercourses if possible.

7.1.2 Mitigation measures are as follows:

- Construction of the Scheme will be subject to measures and procedures as defined within the Outline Environmental Management Plan (OEMP) that have been developed for the Scheme (refer to ES Appendix 4.2). The OEMP includes a range of measures to enable compliance with relevant standards and legislation and best practice guidance to appropriately protect riparian and aquatic environments. The measures detailed within the OEMP will be developed into a CEMP and WMP and implemented by the selected construction contractor.
- Construction works should avoid peak fish migration and spawning seasons if possible.
- Mitigation including fish rescue and translocation may be required during construction of culverts to relocate fish away from the works areas.
- Pollution control measures will be in place for the duration of the works in accordance with the CEMP. These should include designated fuelling areas well away from watercourses, spill kits in all plant/ vehicles on site suitable for fuel and wet trade spillages, and any bowzers for fuelling, pumps, generators, or similar to sit on drip trays to avoid any runoff of fuels. Special care should be taken where in-channel working is required.
- Sediment/ runoff control measures will be required throughout the duration of the construction phase. This will limit the impact of sediment mobilisation or any contaminated runoff.
- Bio-security measures will be required to ensure that no invasive species are spread around site or translocated elsewhere. Measures will need to include checks of plant/ vehicles and footwear to ensure clean and clear of potential contaminants with best practice implemented as necessary.
- The Scheme sustainable drainage design will mitigate runoff quantity from new areas of highways runoff with balancing ponds and swales. Pollution treatment trains will be implemented to control pollutants before attenuated drainage is discharged to water bodies.
- Culverts will be designed appropriately to maintain connectivity along watercourses for aquatic species and riparian mammals. Culverts will include mammal ledges of 500 mm width to facilitate passage of riparian mammals such as otters. Culvert inverts will be set 150 mm below bed level to allow continuity of bed substrate habitats, which will maintain longitudinal connectivity for fish and other aquatic fauna.
- Length-for-length watercourse enhancements are required to mitigate the impacts of new culverts and headwalls.
- If possible, headwalls should be set back from watercourses with green soft ditch connections to the aquatic habitats.

- The existing approximate 74.4 m Moor Ditch culvert will be replaced with an approximate 40 m culvert.
- Watercourse enhancements are required for WFD compliance and at least 150 m of watercourse improvements are required to mitigation for the loss of open channels and the impacts of headwalls.

7.1.3 Given the need for watercourse improvements, space along Meadow Brook has been earmarked in the Scheme boundary (at the junction of the A4130 widening and the Science Bridge) for watercourse enhancements to mitigate culvert and headwall impacts. The existing Meadow Brook is highly modified in this location by historic straightening, and is a low quality, uniform and trapezoidal channel.

7.1.4 The design of watercourse improvements will be undertaken during detailed design of the Scheme. The following measures should be included as far as reasonably practicable:

- Measures to improve the watercourse hydromorphological and ecological conditions (provided this is compatible with flood risk and land drainage functions).
- Natural flood risk measures to support combined WFD, biodiversity and flood management objectives.
- Creation of braided channels in inset floodplains and/ or re-meandering of the watercourse if possible and as far as site extents and design parameters allow.
- Provision of in-channel fluvial geomorphological features such as berms and bars to promote flow sinuosity and width/ depth variation and provide marginal habitat.
- Improvement of morphological flow types such as pools, riffles and runs, to provide aquatic habitat diversity.
- Provision of defined low-flow channels to sustain appropriate flow depths and velocities and improve potential for fish passage.
- Provision of varied channel bank profiles to improve morphological diversity, included areas of shallow-graded channel banks to allow for marginal vegetation growth.
- 7 m wide buffer strip on both sides of the channel if possible, to allow for marginal and riparian habitat improvements.

7.1.5 Watercourse mitigate measures will need to be designed according to flood risk and drainage constraints and within modelled design flood levels and extents.

7.1.6 Such watercourse designs should be undertaken by suitably qualified fluvial geomorphologists, aquatic ecologists, and flood risk specialists, in consultation with the EA Flood Risk and Biodiversity, Geomorphology and Fisheries Officers.

8. Conclusion and recommendations

- 8.1.1 This WFD compliance assessment is based on the Scheme preliminary design and information available at the time of reporting.
- 8.1.2 The Scheme requires a new clear span crossing of the River Thames (Evenlode to Thames) WFD water body (GB106039030334). This is considered a low risk WFD activity without significant impacts on WFD objectives.
- 8.1.3 The Scheme does not overlie a WFD groundwater body. Local groundwater connectivity is limited, and no significant risks to WFD groundwater bodies are anticipated.
- 8.1.4 The majority of the Scheme is within the Moor Ditch and Ladygrove Ditch WFD water body (GB106039023630). This is not designated as a heavily modified water body, but within the vicinity of the Scheme, the entire watercourse network is highly modified by extensive urbanisation and industry. All river channels in the study are extensively culverted, while the remaining sections of open channel are uniform and trapezoidal, and enlarged for flood and drainage capacity. Developments have encroached into floodplains up to bank tops in most places, and riparian vegetation and habitat corridors are generally absent. There are numerous artificial drains and ditches within the floodplain, many of which are associated with highways and other historic developments, and which are generally dry in most weather conditions without offering significant aquatic habitat.
- 8.1.5 The Scheme requires new culvert crossings of Moor Ditch. The new culverts are generally adjacent to existing culverts, so are unlikely to cause any significant habitat network fragmentation compared to the existing baseline. Given the existing highly urbanised and degraded channels, new culverts are unlikely to have a significant impact at the water body scale, and would not prevent future water body improvements since these do not appear feasible in such a densely urban area. New culvert designs will be environmentally sympathetic (more so than existing culverts), and will include allowances for bed habitat continuity and mammal ledges. An existing culvert on Moor Ditch will be shortened to offset new impact lengths as far as possible.
- 8.1.6 In total, there will be a net length of approximately 113.1 m of new culverts and corresponding losses of open channel due to the Scheme. Compared with the approximate 8.398 km water body length within the study area, this represents a net loss of 1.3% of the water body open watercourse habitat.
- 8.1.7 Drainage outfall headwalls may also need to be constructed along the watercourse banks, which will increase physical impact lengths, but details of headwalls have not yet been developed. Ideally
- 8.1.8 A commitment to watercourse enhancement on at least a length-for-length basis is required to mitigate the Scheme impacts of unavoidable new culverts and headwalls for WFD compliance. It is proposed that at least 150 m of watercourse improvements are undertaken along Meadow Brook within the Scheme boundary to mitigate for the loss of open channels and the impacts of headwalls. Following completion of such works there will be no net effect on the water body WFD status.
- 8.1.9 WFD mitigation measures will be developed at detailed design stage, so the details of measures are not yet known. However, the types of mitigation measures required are not novel or complex, and rather are proven, practicable techniques commonly adopted in Sustainable Drainage Systems for schemes of this type. As such there is

high confidence that suitable WFD mitigation measures will be incorporated at detailed design stage.

8.1.10 WFD impact assessment will be required at detailed design to verify WFD compliance and support the Scheme's sustainable design and environmental impact mitigation.

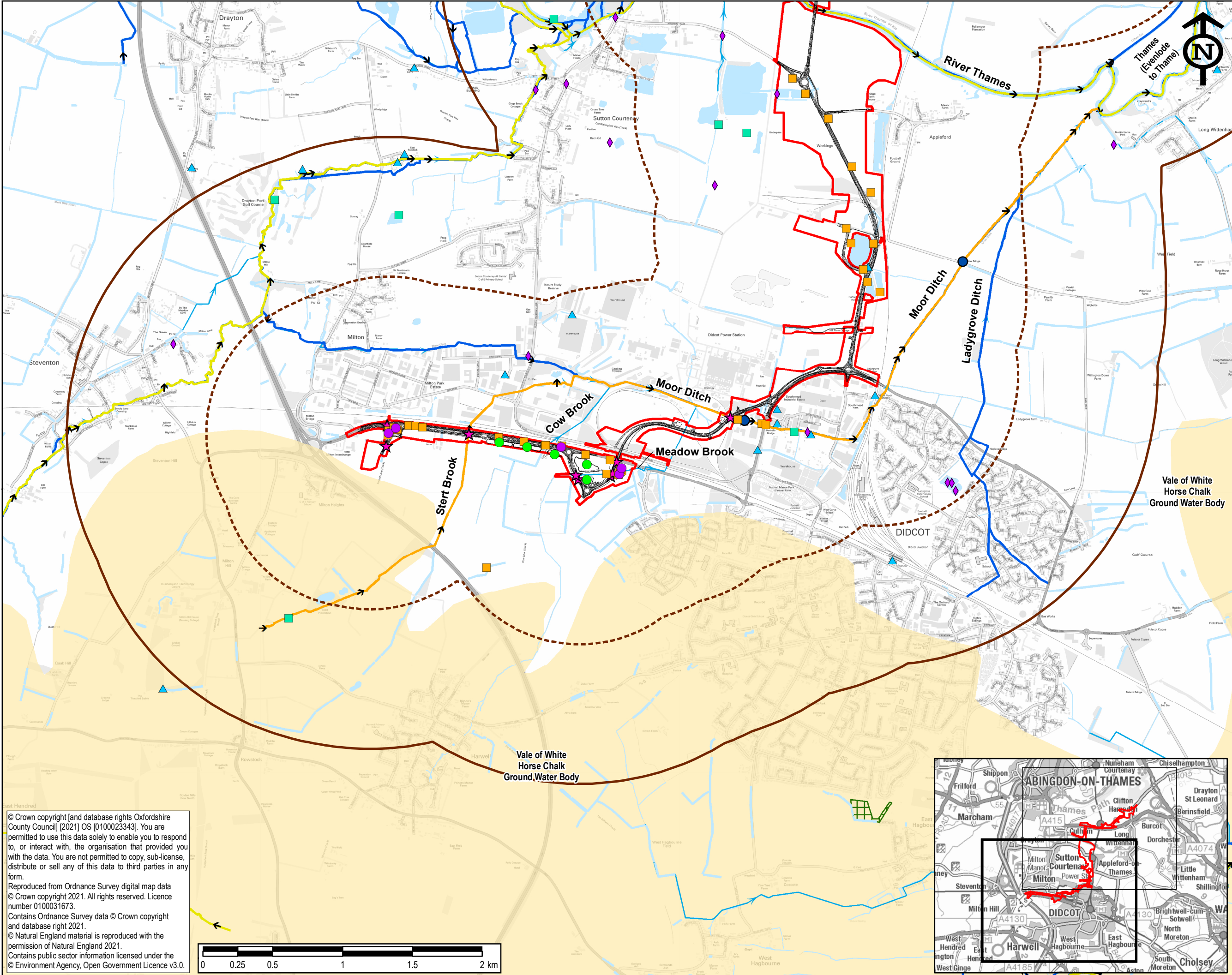
8.1.11 In accordance with the above, it is considered that the Scheme will **not**:

- Cause a deterioration in ecological status/ potential of the water body (e.g. from moderate to poor);
- Prevent the waterbody from meeting its objective of good ecological status/ potential;
- Prevent or compromise WFD objectives being met in other water bodies;
- Cause failure to meet good groundwater status or result in a deterioration of groundwater status; and
- Prevent the implementation of mitigation measures which define the hydromorphological designation of heavily modified waterbodies.

9. References

- Ref 1 Environment Agency (2016a). Water Framework Directive Risk Assessment. How to assess the risk of your activity. Available at: <https://www.gov.uk/government/publications/water-framework-directive-how-to-assess-the-risk-of-your-activity>. Last accessed May 2021.
- Ref 2 Environment Agency (2016b). Protecting and improving the water environment. Water Framework Directive compliance of physical works in rivers. Environment Agency internal position statement; made available to AECOM as a result of a data request.
- Ref 3 The Planning Inspectorate (2017). Advice Note eighteen: The Water Framework Directive. Available from: <https://infrastructure.planninginspectorate.gov.uk/legislation-and-advice/advice-notes/>. Last accessed May 2021.
- Ref 4 AECOM (2021) DGT HIF 1 Scheme Drainage Strategy.

Annex A Scheme and Water Body Overview



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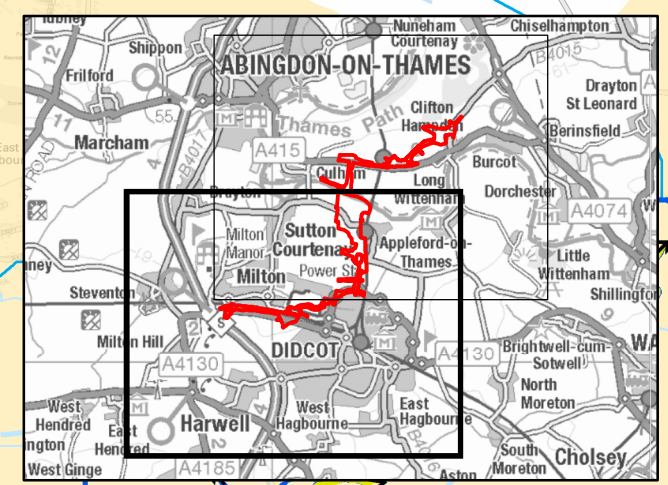
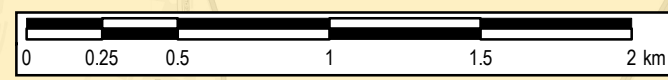
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- Red Line Boundary 1km Buffer
- Red Line Boundary 2km Buffer
- Indicative OCC Highway Design (Subject to Change)
- Third Party Basin
- Pond
- Outfall
- Culvert
- Local Nature Reserve*
- Pollution Incident
- Water Activity Permit
- Abstraction License
- Main River
- Ordinary Watercourse
- Surface Water
- Environment Agency Water Quality Monitoring Location
- WFD Surface Water - Ecological Class:
 - Moderate
 - Poor
- WFD Ground Water - Overall Class:
 - Poor

NOTE:
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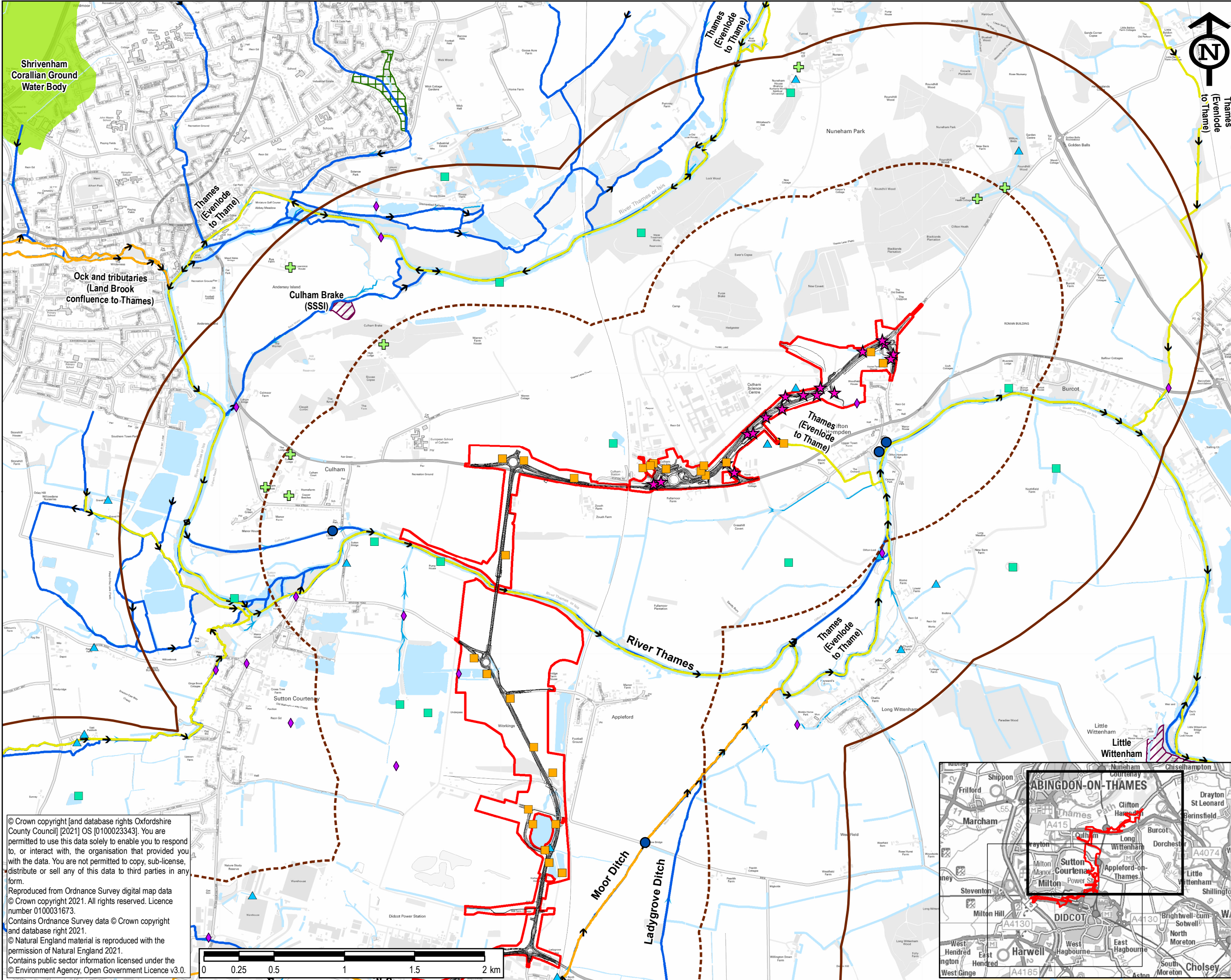
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Revision Details	By	Check	Date
Purpose of Issue			
FOR INFORMATION			
Client			
County Hall New Road Oxford OX1 1ND			
Project Title			
DIDCOT GARDEN TOWN HIF 1 SCHEME			
Drawing Title			
ANNEX A WATER RESOURCE FEATURES AND DRAINAGE STRUCTURES SHEET 1 OF 2			
Designed SG	Drawn AG	Checked LC	Approved TJ
Internal Project No. 60606782		Suitability S2	
Scale @ A3 1:25,000		Discipline Water	
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Drawing Number Work Package ID GEN_PD DGT_ZZ_ZZ_ZZ	Originator -ACM	Volume -EWE -FG-HD-0010	Rev P01

Plot Date: 27 May 2021 11:22:28
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Plot Date: 27 May 2021 11:22:28
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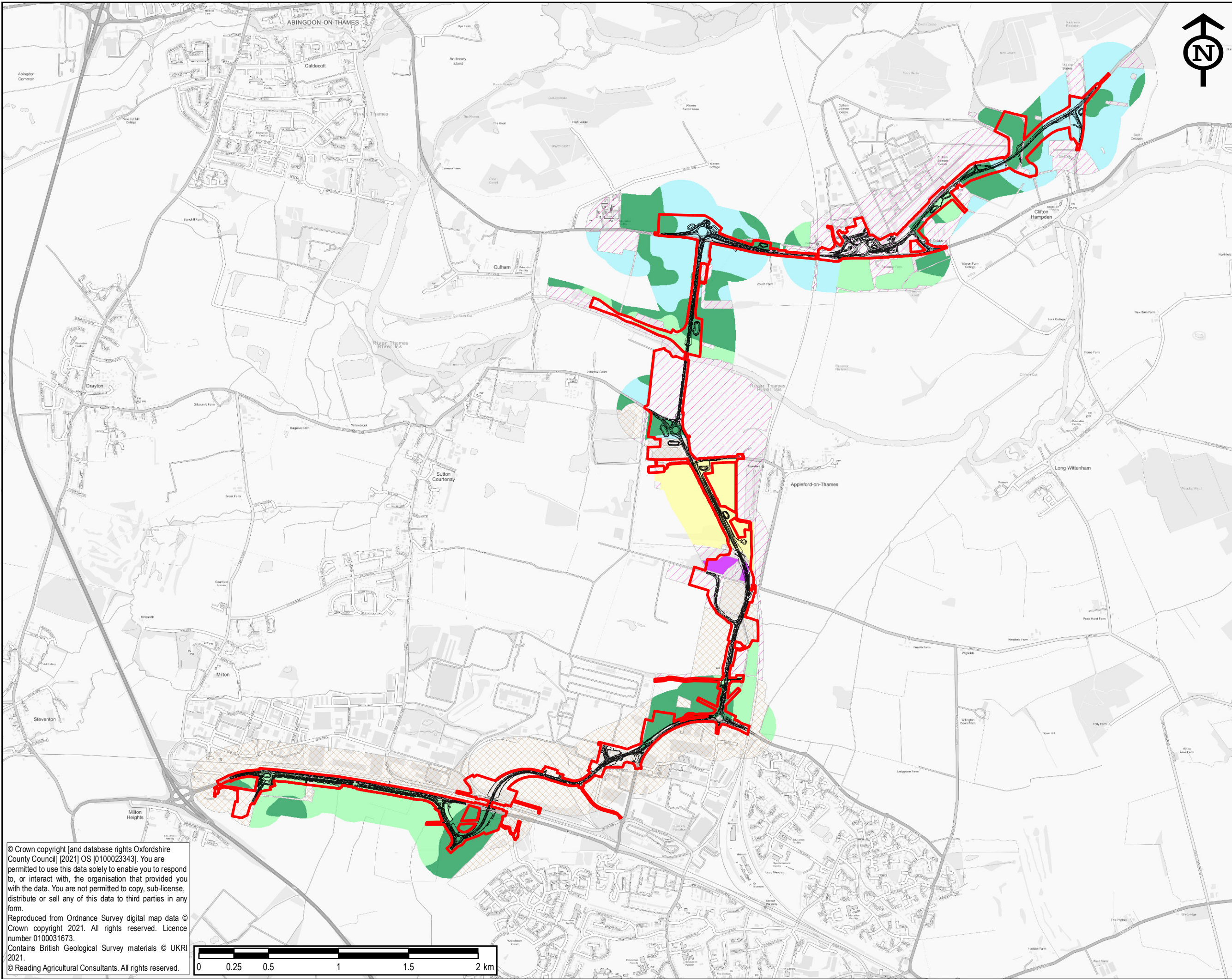
- Indicative Red Line Boundary (Subject to Change)
- Red Line Boundary 1km Buffer
- Red Line Boundary 2km Buffer
- Indicative OCC Highway Design (Subject to Change)
- Outfall
- Culvert
- Site of Special Scientific Interest
- Local Nature Reserve*
- Private Water Supply
- Pollution Incident
- Water Activity Permit
- Abstraction License
- Main River
- Ordinary Watercourse
- Surface Water
- Environment Agency Water Quality Monitoring Location
- WFD Surface Water - Ecological Class:
 - Moderate
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 - Good
 - Poor

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First Issue	AG	TJ	26/05/21	P01
Revision Details	By	Check	Date	Suffix
Purpose of Issue	FOR INFORMATION			
Client	OXFORDSHIRE COUNTY COUNCIL			
Project Title	DIDCOT GARDEN TOWN HIF 1 SCHEME			
Drawing Title	ANNEX A WATER RESOURCE FEATURES AND DRAINAGE STRUCTURES SHEET 2 OF 2			
Designed SG	Drawn AG	Checked LC	Approved TJ	Date 27/05/2021
Internal Project No. 60606782	Suitability S2			
Scale @ A3 1:25,000	Discipline Water			
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Drawing Number Work Package ID GEN_PD DGT_ZZ_ZZ_ZZ	Originator -ACM	Volume -EWE - -FG -HD -0010	Type Role	Rev P01

Annex 12 – Figure 11.2: Agricultural Land Classification

Plot Date: 12 May 2022 16:02:57
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LEGEND

Indicative Red Line Boundary (Subject to Change)

Indicative OCC Highway Design (Subject to Change)

Agricultural Land Classification:

- 2
- 3a
- 3b
- 4
- Other
- Non Agricultural
- Not surveyed

First Issue	AG	TJ	16/04/21	P01
Revision Details	By	Check	Date	Suffix

Purpose of Issue

FOR INFORMATION

Client

County Hall
New Road
Oxford
OX1 1ND

OXFORDSHIRE COUNTY COUNCIL

Project Title

**DIDCOT GARDEN TOWN
HIF 1 SCHEME**

Drawing Title

**FIGURE 11.2
AGRICULTURAL LAND
CLASSIFICATION**

Designed SG	Drawn AG	Checked LC	Approved SB	Date 12/05/2022
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Internal Project No. 60606782	Suitability S2
Scale @ A3 1:25,000	Discipline Geology

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Originator	Location	Role			P01

